DOCUMENT RESUME

ED 160 355 SE 024 728

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TITLE Diseases of Ornamental and Shade Trees, Shrubs, Vines, and Ground Covers.
INSTITUTION Pennsylvania State Univ., University Park. Coll. of Agriculture.; Pennsylvania State Univ., University Park. Cooperative Extension Service.
PUB DATE [75]
NOTE 90p.; For related documents, see SE 024 723-736

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Disease Control; Environmental Education; *Extension Education; *Ornamental Horticulture; *Pesticides; *Plant Pathology; Plant Science; *Trees
IDENTIFIERS *Pennsylvania State University

ABSTRACT

This agriculture extension service publication from Pennsylvania State University covers the identification and control of common ornamental trees, shrubs, and ground cover diseases. The publication is divided into sections. The first section discusses the diseases of ornamental and shade trees, including general diseases and diseases of specific plants. The second section discusses the diseases of shrubs, vines, and ground covers, including general diseases and diseases of specific plants. The third section discusses control measures for the plant diseases listed in the previous sections. Most of the information in this publication is grouped under specific plants and the plants are alphabetized for easy referral. Also, a small fourth section listing disease resistant of trees and discussing mixing preparations of wettable powder fungicides is included. (MR)

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DISEASES OF ORNAMENTAL AND SHADE TREES, SHRUBS, VINES, AND GROUND COVERS

SE 024 728

College of Agriculture, The Pennsylvania State University, University Park, Pennsylvania

CONTENTS

ORNAMENTAL AND SHADE TREES
GENERAL DISEASES
Leaf Scorch..... 1
Powdery Mildew..... 1
Sooty Mold..... 1
Verticillium Wilt..... 1
DISEASEAS OF SPECIFIC PLANTS
Ailanthus..... 2
Arborvitae..... 2
Ash..... 2
Aspen..... 2
Basswood..... 3
Beech..... 3
Birch..... 3
Black Locust..... 3
Buckeye..... 3
Butternut..... 3
Catalpa..... 4
Chestnut..... 4
Crabapple, Flowering.... 5
Dogwood..... 5
Elm..... 6
Hackberry..... 8
Hawthorn..... 8
Hemlock..... 9
Hickory..... 9
Horse Chestnut..... 9
Juniper, Red Cedar..... 10
Linden, Basswood..... 10
Magnolia..... 11
Maple..... 11
Mimosa..... 12
Mountain Ash..... 12
Oak..... 12
Pine..... 13
Plane Tree..... 14
Poplar..... 14
Redbud..... 15
Red Cedar..... 15
Smoke-Tree..... 15
Spruce..... 15
Sycamore..... 16
Tree of Heaven..... 16
Tulip Tree..... 16
Walnut, Black..... 17
Walnut, English
or Persian..... 17
Willow..... 17

SHRUBS, VINES, AND GROUND COVERS
GENERAL DISEASES
Nematodes..... 19
Powdery Mildew..... 19
Shoestring Root Rot..... 20
DISEASES OF SPECIFIC PLANTS
Ajuga, Bugle-weed..... 21
Alder..... 21
Almond, Flowering..... 21
Azalea..... 21
Barberry..... 23
Bayberry..... 23
Bittersweet..... 23
Boxwood..... 23
Buckthorn..... 24
Buttonbush..... 24
Cherry, Hansen's Bush..... 24
Chokeberry..... 24
Clematis..... 25
Cotoneaster..... 25
Daphne..... 25
Dutchmans-Pipe..... 25
Euonymous..... 25
Firethorn..... 26
Forsythia, Golden Bell..... 26
Holly..... 26
Honeysuckle..... 27
Hydrangea..... 27
Ivy, Boston and
Virginia Creeper..... 27
Ivy, English..... 28
Kerria..... 28
Laurel, Mountain..... 28
Leucothoe..... 29
Lilac..... 29
Mahonia, Oregon Grape..... 29
Matrimony Vine..... 29
Mock Orange..... 30
New Jersey Tea..... 30
Pachysandra..... 30
Perwinkle, Ground Myrtle..... 30
Privet..... 30
Quince, Japanese Flowering..... 31
Red-Osier Dogwood..... 31
Rhododendron..... 31
Serviceberry, Shadbush..... 32
Snowberry..... 32
Staghorn Sumac..... 32
Sweet Fern..... 33
Trumpet Vine..... 33
Viburnum..... 33
Witch Hazel..... 33

DISEASE CONTROL MEASURES
Ornamental and Shade Trees..... 35
Shrubs, Vines, and Ground Covers.... 49

ORNAMENTAL AND SHADE TREES

GENERAL DISEASES

LEAF SCORCH

Leaves of ash, beech, dogwood, elm, horse chestnut, linden, maple, and oak often are affected by a noninfectious disease which causes a browning between veins or along margins of the leaves. Scorch usually develops during July and August and is especially severe following periods of drying winds and high temperatures, when the roots are unable to supply enough water to the tree to replace the large amount of water lost through the leaves. The condition may also result from shallow soils, roots which girdle the base of the tree, a diseased root system, drought, and diseases which weaken the tree. Fir, pine, and spruce often show leaf scorch as a brown discoloration of needle tips. Scorch on needles may be the result of hot, dry weather or of high winds during cold weather.

POWDERY MILDEW

Fungi of the powdery group infect the leaves of various trees, producing patches of white or gray powdery coating on the leaf surface. Tiny black fruiting bodies of the powdery mildew fungus are often found on the white patches. Trees commonly affected with powdery mildew in Pennsylvania are catalpa, crabapple, dogwood, horse chestnut, linden, magnolia, sycamore, and tulip.

SOOTY MOLD

Various fungi grow as saprophytes on honeydew secretions of such insects as aphids and scales. These fungi form a heavy sooty growth which partially or completely covers the needles of several evergreens and the leaves of elm, linden, magnolia, maple, and tulip trees. Although the heavy coating of mold on leaves is unsightly, it does not seem to interfere seriously with food manufacture within the leaf.

VERTICILLIUM WILT

This fungus-caused (Verticillium dahliae) disease occurs on at least 46 woody plants grown in Pennsylvania. Maples are the most important group of highly susceptible woody plants. The pathogen is soilborne and can persist many years in soil without host plants. The disease is common in nurseries that have been established on land formerly devoted to fruit, bramble, vegetable, or field crops.

Plants Resistant to Verticillium Wilt -- Yews and conifers are not affected by Verticillium wilt. Many broadleaved trees and shrubs commonly planted in Pennsylvania also seem to be resistant. Some of these are:

Birches	Sweet gum
Katsura tree	Flowering crab
Hornbeams	Mulberry
Many dogwoods	Plane trees, sycamore
Hawthorns	Firethorn
Ginkgo, maidenhair tree	Willows
Honey locusts	European mountain ash

DISEASES OF SPECIFIC PLANTS

AILANTHUS, TREE OF HEAVEN

Verticillium Wilt -- The fungus causes a wilting and yellowing of foliage followed by premature defoliation. One limb or the entire tree may be affected. Trees may wilt and die suddenly or they may die back gradually over a period of years. Yellowish-brown streaks are present in outer rings of the wood of infected branches.

ARBORVITAE

Twig Blight -- The fungus, Phomopsis juniperovora, infects young leaves and twigs, and causes browning and dieback. Black, minute, fruiting bodies of the fungus may be found on diseased portions. During wet weather, spores ooze out of the fruiting bodies and are spread by rain and overhead irrigation. Red cedars are especially susceptible to this disease. It is extremely destructive in seedbeds, cutting beds, and lined-out stock nurseries.

ASH

Anthracnose or Leaf Spot -- The fungus, Gloeosporium aridum, causes large irregular brown spots, usually along the edges of the leaves. Affected leaves fall prematurely. The fungus overwinters in fallen diseased leaves.

Leaf Scorch -- See GENERAL DISEASES

Rust -- The fungus, Puccinia sparganioides, causes swollen distorted areas on leaves and twigs. The swollen areas become covered with minute cups, within which yellow powdery spore masses develop. These spores cannot reinfect ash leaves and twigs, but they infect certain marsh grasses on which overwintering spores are formed. Reinfection of ash occurs in the spring from spores formed on grasses.

ASPEN

See POPLAR

BASSWOOD

See LINDEN

BEECH

Leaf Mottle or Scorch -- This disease appears in the spring on young unfolding leaves. Small, semi-transparent spots are surrounded by yellowish-green to white areas. These spots enlarge, turn brown and dry, and are prominent between the veins near the midrib and along the edge of the leaf. Later, entire leaves become scorched, and premature leaf fall follows. In July a normal set of leaves develops to replace fallen leaves. However, severe scalding of the bark on branches may occur as a result of premature defoliation exposing the branches to direct rays of the sun.

BIRCH

Crown Gall -- This bacteria-caused (Agrobacterium tumefaciens) disease stimulates cell growth on roots, trunks, and branches; warty, tumor-like swellings with irregular rough surfaces are formed. Small galls are the size of a pea, and those on the trunk sometimes grow to 1 to 2 feet in diameter. Tree growth may be retarded, leaves may turn yellow, and branches or roots may die.

BLACK LOCUST

Brooming Disease -- A virus causes abnormal development of buds into short, spindly shoots which have smaller than normal leaves. Buds on these spindly branches also develop abnormal branches, resulting in the broom-like appearance of the tree. The brooming usually occurs late in summer, and the shoots often die during winter. Roots of infected trees are shorter, darker, and more brittle than normal. Excessive rebranching of the roots gives a broom-like appearance to the roots.

BUCKEYE

See HORSE CHESTNUT

BUTTERNUT

Dieback -- The fungus, Melanconis juglandis, produces a dark discoloration of the bark on small branches, causing a dieback which progresses down the branches to the trunk. The severely affected trees eventually die. Dead branches are

covered with small, black, pimple-like fruiting bodies of the causal fungus. In wet weather, spores ooze out in a black inky mass from fruiting bodies and are splashed and blown to infect other branches.

Anthracnose or Leaf Spot -- This fungus-caused (Gnomonia leptostyla) disease creates irregular dark-brown spots on the leaves. Severe infection results in premature defoliation.

CATALPA

Leaf Spots -- Several fungi cause brown to black spots on leaves. Infected tissue within the spots may drop, leaving holes in the leaves; premature leaf fall may follow.

Powdery Mildew -- See GENERAL DISEASES

Verticillium Wilt -- Purple to bluish-brown streaks in sapwood of wilted branches are an indication of the presence of this wilt disease. Affected trees may die the year of infection or may live for many years.

CHESTNUT

Blight -- This disease is caused by the fungus Endothia parasitica. Cankers form on twigs, branches, and trunks of infected trees. On young wood the cankers are swollen, yellow-brown, oval or irregular areas. On older wood they are brownish, circular or irregular areas with slightly raised or depressed edges. Partial or complete girdling of stems by cankers causes leaves to yellow and brown. Dead leaves and burrs cling to diseased branches long after normal leaf fall.

The surface of older cankers is covered with minute pinpoint fruiting bodies of the blight fungus. During wet weather, yellowish spore masses ooze from fruiting bodies. These spores are carried by rain, birds, and insects. New infection follows when spores enter through wounds.

American and European chestnuts are very susceptible to this disease. Chinese and Japanese chestnuts are resistant but not immune.

Leaf Spot -- The causal fungus, Marssonina ochroleuca, infects leaves causing small, circular, yellow to brown spots with concentric markings. The spots may drop out and leave small holes in the leaf. Premature defoliation may follow.

Twig Canker -- Chinese and Japanese chestnuts, while having resistance to blight, are very susceptible to attack by this disease-causing fungus (Cryptodiaporthe castanea). Cankers form on twigs, limbs, and trunks. Girdling by cankers causes death of branches.

CRABAPPLE, FLOWERING

Cedar-Apple Rust -- A fungus, Gymnosporangium juniper-virginiana, causes orange areas 1/8 to 3/4 inch in diameter on leaves and fruit. The upper surface of these areas on leaves is covered with minute black dots within a reddish circle. On the undersurface of the leaf, and also on the fruit, the orange spots may have many small, cup-shaped structures with fringed edges. In late summer, spores from the cups infect red cedar and other juniper trees where, after 18 to 20 months, a different type of spore is produced on galls to reinfect crab and apple trees.

Severe infection of leaves and twigs may cause early leaf fall and dwarfing. On Bechtel's crab, which is very susceptible to the disease, repeated infection may cause death of branches or of the entire tree.

Fire Blight -- This disease is caused by a bacterium, Erwinia amylovora. New shoots suddenly wilt, become brown or black, and die. The leaves on these shoots die, hang downward, and cling to the blighted twigs. The disease usually becomes more serious when crabapple trees are planted near pears, which harbor the disease-causing bacteria. The Redbud, Tea, and Van Eseltine crabapples are very susceptible to fire blight.

Scab -- The fungus, Venturia inaequalis, infects leaves, causing dull, smoky areas which change to olive-green moldy spots without definite margins. The leaves may turn yellow and fall prematurely. On fruit, the spots are small, round, dark-olive areas which, as they increase in size, become corky in the center.

The fungus overwinters in fallen leaves and in twig cankers. During spring rains, spores are ejected from fruiting bodies in old leaves and are carried by air currents to infect newly opened leaves. Some very susceptible crabapples are Almey, Hopa, Jay Darling, and Strathmore.

Powdery Mildew -- See GENERAL DISEASES

DOGWOOD

Crown or Trunk Canker -- This is the most serious disease of transplanted flowering dogwood. The disease is caused by a fungus, Phytophthora cactorum. Trees with low vitality, particularly those growing in poorly drained soil or those suffering from drought, are often infected. The leaves of infected trees, smaller and lighter green than normal, turn red prematurely in late summer. Later, twigs and even large branches die. A canker may be found on the lower trunk at or near soil level where the fungus invaded bark, cambium, and outer sapwood and caused a discoloration of infected tissues. The cankers enlarge slowly for several years, extend completely around the base of the trunk or root collar, and kill the tree. For a few years before their death, infected trees often bear large flower and fruit crops.

Flower and Leaf Blight -- Flowers are infected at the end of their bloom period. The fungus, Botrytis cinera, causes irregular, brown, wrinkled patches on the bracts. If the weather remains humid, these patches may be covered with a grayish mold. Infected bracts may fall on the young leaves and cause leaf infections. Infected leaves may fall, but the leaf drop is usually not serious.

Leaf Scorch -- See GENERAL DISEASES

Leaf Spot -- Angular grayish spots with dark purple margins occur on leaves. The disease, caused by the fungus Septoria cornicola, is most common during wet seasons.

Powdery Mildew -- See GENERAL DISEASES

Spot Anthracnose -- A fungus, Elsinoe corni, causes a spotting of the flowers and of the leaves, stems, and fruit. The spots on bracts are reddish-purple and may be as large as 1/10 inch in diameter. Spotting of bracts may be so severe that flowers are disfigured. Badly infected flower buds may never open.

Spots on leaves appear as circular to angular dark purple areas usually less than 1/25 inch in diameter. Diseased leaf tissues often drop out, leaving holes or ragged edges. Severely infected leaves may be reduced in size or be killed.

Spots on fruit and stems may be abundant. The surrounding tissue may be dark, and the spots are often slightly raised.

Twig Blight -- Twigs of native dogwood die back. This disease, caused by the fungus Myxosporium everhartii, may be confused with the more extensive dying back of trees infected with crown canker.

ELM

Black Leaf Spot -- This disease is caused by the Gnomonia ulmea. Leaves become infected as they unfold in the spring; grayish, irregular spots occur on the upper leaf surface. Later the spots enlarge to about 1/8 inch in diameter and shiny black dots appear in the center. Infected leaves turn yellow, and during wet seasons, premature leaf-fall may be heavy.

Dothiorella Wilt or Dieback -- The fungus, Dothiorella ulmi, infects trees through wounds, causing a wilting and yellowing of leaves. Cankers are formed which cause a dieback of affected branches. Diseased bark on the cankers becomes shrunken and reddish-brown with black, raised pustules appearing in the dead bark. A brown discoloration of the sapwood may be confused with that caused by Dutch elm disease or Verticillium wilt.

Dutch Elm Disease -- Dutch elm disease was first observed in the United States in Ohio in 1930. Since then it has spread throughout the east and as far west as Idaho. All American elm species are susceptible. This disease has eliminated elms from many eastern and midwestern communities.

Dutch elm disease is caused by a fungus, Ceratocystis ulmi, which invades and plugs the water-conducting system of the tree. The foliage wilts and turns yellow, usually first on one or more individual branches, but soon on the whole tree. Leaves may curl and turn yellow before falling, or may wither and fall suddenly while still green. Infected trees may die within a few weeks or may decline slowly over a period of one year or more. Affected branches develop a brown discoloration in the outer layers of sapwood just under the bark. On the ends of cut twigs, the discoloration may appear as a complete browning of one or more of the outermost annual rings.

The causal fungus is carried from tree to tree by two species of elm bark beetles--the smaller European elm bark beetle and the native elm bark beetle.

The infection cycle begins in the spring during May when adult bark beetles emerge from infected trees. If overwintering took place in trees killed by Dutch elm disease, then many of the emerging beetles will have sticky spores of the Dutch elm fungus on their bodies. The emerging beetles seek living, healthy elms where they feed in crotches of small twigs. Fungus spores are deposited in water-conducting tubes opened by the feeding injury. Elms so inoculated usually develop the disease during that summer. The majority of the beetles feed 600 feet or less from the dead wood in which they overwintered. Where elms are scarce, beetles may fly several miles in search of feeding sites.

After feeding for a few days, the beetles seek a suitable egg-laying site. They require dying or recently dead elm wood with the bark still tightly attached. This may be a standing dead tree, a log, a weakened tree, or a weakened branch on a healthy tree. Wood also may be inoculated during the egg-laying activities of beetles carrying the fungus. Thus, elms weakened or killed by any means may become infected with the fungus and become a source of a new brood of infectious beetles.

Beetles will not infest wood without bark or with loose, cracked bark such as that on old logs or on trees dead more than a year. Beetles reproduce in all species of elm.

Although broods of bark beetles may occur every 35 to 40 days during the summer, much of the spread of the disease is associated with the feeding injuries of the first spring brood. At this season, the long water-conducting tubes in the wood of elms are near the surface and are easily opened by the beetles' feeding.

An important factor in the spread of the disease is the egg-laying site of the last brood of the season. If these adults lay eggs in Dutch-elm-disease-killed trees, it is likely that beetles emerging next spring will be coated with fungus spores. If such trees are removed during the winter, the threat of infection is greatly reduced.

Elms Resistant to Dutch Elm Disease -- Although none of the species of elms is immune to Dutch elm disease, some are highly resistant; however, these species are smaller and lack the desirable vase-shaped form of the American elm. Resistant species are Ulmus pumila, the Siberian elm, and Ulmus parvafolia, the Chinese elm. A Netherlands elm, the Christine Buisman elm, is also resistant. However, this selection is susceptible to the elm leaf beetle and is not winter hardy in the northernmost range of the Americal elm.

Leaf Scorch -- See GENERAL DISEASES

Phloem Necrosis -- This destructive disease of American elms is caused by a mycoplasma. Leaves turn bright yellow, then brown, and they finally fall off. Trees infected during spring or early summer may live through the winter, produce a thin crop of leaves, and die the next summer.

The inner layers of bark of the roots and lower trunk of affected trees, when freshly peeled, show a butterscotch color and have a faint odor of wintergreen. The mycoplasma causing this disease is spread from tree to tree by leafhoppers.

Sooty Mold -- See GENERAL DISEASES

Verticillium Wilt -- Leaves yellow and wilt. Browning of the sapwood under the bark resembles that caused by Dutch elm disease.

Wetwood (Slim flux) -- The bacterium Erwinia nimipressuralis causes this disease by infecting the wood of elm and other hardwoods, such as maple, birch, oak, poplar, sycamore, and willow. The infection results in an increase of internal sap pressure. Sap seeps out of infected areas through cracks, wounds, and pruning cuts and flows down the trunk soaking large areas of bark.

The seepage often becomes contaminated with bacteria and yeasts, resulting in a foul-smelling substance called slime flux. The slime flux may prevent healing of wounds and may kill bark and wood over which it flows. Toxic sap from infected wood may be carried to branches, where wilting and defoliation may occur. A browning of the tissues between veins along edges of leaves is found on affected branches. The wood under the bark of wilted branches often shows grayish-brown streaks similar to those found with Dutch elm disease.

HACKBERRY

Witches' Broom -- A powdery mildew fungus and a specific gall mite are usually associated with broom-like growths on branches of hackberry. Several hundred galls may be found on a single tree, causing an unsightly appearance in the winter. Affected branches are weakened and break easily during wind storms; the broken wood is exposed to wood-decay fungi. Affected buds are larger and more open and hairy than normal. Mites may be found inside the buds along with small black fruiting bodies of the mildew fungus. Thread-like strands of mildew are found on the outside of the bud. Branches that develop from these buds are dwarfed and clustered, giving the witches' broom effect.

HAWTHORN

Fire Blight -- New shoots suddenly wilt, become brown or black, or die. The leaves die, hang downward, and cling to the blighted twigs. Blossoms and fruit spurs are killed. The English hawthorn and the cockspurthorn are susceptible.

Leaf Spot -- This fungus (Diplocarpon maculata) disease appears as small, angular reddish-brown spots on leaves. Infected leaves turn yellow and fall. Severely infected trees may lose almost all of their leaves. The English hawthorn and Paul's scarlet hawthorn are very susceptible to this disease.

Leaf Blight and Fruit Rot -- Wilting and blighting of leaves occurs during mid-May. Single blossoms or entire flower clusters wilt, die, turn brown, and hang on the twigs before falling off. All or part of the leaf may turn brown. A fruit rot generally follows leaf infection. This disease may be confused with bacterial fire blight; with fire blight, the affected tissues are more blackened.

The causal fungus, Monilinia johnsonii, overwinters on fallen, mummified fruits which have been partly buried in the ground.

Rust -- Rust on hawthorn may be caused by either of two fungi. The fungus Gymnosporangium clavipes causes severe deformation of leaves, twigs, and fruit. The orange-colored spores of the causal fungus are produced in tiny whitish tubes on the surface of the fruit and on swollen parts of the twigs.

Another fungus, G. globosum, infects leaves, causing gray to brown spots. The fruit also may be infected and covered with the brownish horn-shaped fruiting bodies. Both of these rust fungi require the presence of red cedars and other species of juniper for continued spread of the disease.

HEMLOCK

Twig and Branch Canker -- Cankers caused by the fungus Cytospora sp. form on twigs and branches. Branches girdled by cankers die. Embedded fruiting bodies of the causal fungus break through the bark of the cankers and produce thread-like masses of spores during wet weather.

HICKORY

Leaf Spot -- A fungus, Gnomonia caryae, causes irregular, reddish-brown spots on the upper leaf surface and brown spots on the lower leaf surface. Severe infection may cause leaf fall. The fungus overwinters in fallen leaves.

HORSE CHESTNUT

Leaf Blotch -- On the leaves, small, irregular, reddish-brown spots with yellowish edges appear in late June or early July. The spots enlarge, browning and curling the leaflets so that by August, the trees appear to be scorched by fire.

Many affected leaves drop prematurely. Tiny black fruiting bodies of the causal fungus, Guignardia aesculi, may be found on affected portions of the leaves.

Leaf Scorch -- This condition appears as irregular, scattered, light or dark brown areas along the margins or between the veins, and it may be confused with leaf blotch. Leaves affected with leaf scorch do not have the tiny black fruiting bodies found on leaves affected with leaf blotch.

Powdery Mildew -- See GENERAL DISEASES

JUNIPER, RED CEDAR

Rusts -- The causal fungus, Gymnosporangium juniperi-virginiana, stimulates leaves of red cedar to form small, deep-red smooth, globular galls in the first spring after infection.

The galls mature in the second spring after infection, and may be as large as two inches in diameter. Galls are greenish-brown, globular to irregular-shaped, and corky. Their surface becomes covered with small pit-like depressions, the center of each pit having a small pimple-like protuberance. During spring rains, many gelatinous, orange spore-horns protrude from these horns are carried by wind and insects to leaves or fruits of nearby alternate host plants such as apple and ornamental crab-apple. These alternate host plants are needed for the completion of the life cycle of the rest fungus, since the spores produced on juniper are unable to reinfect juniper. If the alternate hosts are removed, the life cycle is broken and the rust fungus cannot survive.

Other rust fungi commonly found on junipers are hawthorn rust, which forms smaller galls on the leaves; quince rust, which forms slight swellings on twigs and branches; and serviceberry or shadbush rust, which stimulates the formation of witches' brooms.

Twig Blight -- See ARBORVITAE

LINDEN, BASSWOOD

Anthracnose or Leaf Blotch -- The fungus, Gnomonia tiliae, causes small, circular to irregular brown spots which grow together and form blotches along the main veins of leaves, leaf stems, and twigs. A conspicuous black margin is found between healthy and dead tissue. In wet seasons, leaf fall may be severe.

Leaf Scorch -- See GENERAL DISEASES

Leaf Spot -- The causal fungus, Cercospora microsora, infects leaves, causing small, circular light-brown spots with dark margins. Where the spots are numerous, they may grow together and cause leaves to fall prematurely.

Powdery Mildew -- See GENERAL DISEASES

Sooty Mold -- See GENERAL DISEASES

Verticillium Wilt -- The fungus causes a sudden wilting and dying of the leaves on one or several branches. Wilted leaves usually fall, but they may remain on the tree. Brown streaks may be found in the young sapwood of affected branches.

MAGNOLIA

Powdery Mildew -- See GENERAL DISEASES

Sooty Mold -- See GENERAL DISEASES

MAPLE

Anthracnose -- On Norway maple, narrow, purple to brown streaks occur along the veins of leaves; on sugar maple, large, irregular, green-brown or red-brown areas occur along and between the veins extending out to the edge of leaves. On sugar maple, infected leaves may be confused with leaves showing scorch symptoms resulting from drought and heat injury. (Small brown fruiting bodies of the causal fungus, Gloeosporium apocryptum, are found along the veins of leaves infected with anthracnose, and are not found on leaves showing scorch symptoms.) During wet seasons, infection may be severe enough to cause partial defoliation.

Bleeding Canker -- The fungus, Phytophthora cactorum, infects Norway, red, sycamore, and sugar maples, causing reddish-brown cankers in the inner bark of the trunk and in the main branches. The bark becomes furrowed and sunken over the cankers, and reddish-brown sap oozes through openings in the outer bark. Branches die back and leaves may wilt.

Leaf Spot -- The fungus, Phyllosticta minima, infects leaves causing small, irregular, circular brown spots, with a pronounced purple border. The spots may be only one-quarter inch in diameter, or they may grow together to involve half the leaf. Tiny black fruiting bodies of the causal fungus are formed on the upper surface of the spots. In wet seasons, leaf fall may be heavy.

Leaf Scorch -- See GENERAL DISEASES

Sooty Mold -- See GENERAL DISEASES

Tar Spot -- Two fungi infect the leaves of red and silver maple, causing oval to irregular, shiny black, thickened, raised spots. One fungus, Rhytisma acerinum, causes spots about 1/4 to 1/2 inch in diameter; the spots caused by the other fungus, R. punctatum, are not more than 1/8 inch in diameter and they create a more speckled effect on the leaves.

Verticillium Wilt -- The fungus infects maples, causing the leaves on one or several branches to wilt and die. Wilted leaves usually fall, but they may remain on the tree. If many branches have wilted leaves, the tree may die.

On slightly affected trees, wilted branches do not die, but produce a new crop of leaves by fall or in the following spring. Small, sickly looking foliage results from infection on the entire tree. The causal fungus produces green streaks in sapwood at the base of wilting branches and in the trunk and roots of affected trees.

Silver, Norway, and sugar maples are especially susceptible to this disease.

MIMOSA

Wilt -- The fungus Fusarium oxysporum f. sp. pernicosium causes a wilting, followed by death of foliage on one or several branches of the tree. Infected trees usually die a month to a year after the first appearance of the disease. A brown ring of discolored sapwood is found, usually in the current annual ring of the stems and branches.

MOUNTAIN ASH

Cytospora Canker -- Trunks and larger branches of weakened mountain ash are infected with brownish shrunken patches on the bark. Diseased areas may be circular or irregular in shape and will gradually enlarge until the branch or trunk is girdled. Black, pinpoint fruiting bodies of the causal fungus are formed on infected bark, and during moist weather, yellow or reddish thread-like masses of fungus spores ooze out of these bodies to be splashed by rain to other trees.

Fire Blight -- Mountain ash trees are susceptible to infection by the same bacterial fire blight which attacks apples, hawthorns and pears. Young leaves, twigs, and flowers suddenly wilt, turn brown and black, and appear to have been scorched by fire. Infection may spread to involve large branches.

Leaf Spot -- A fungus, Phyllosticta globergera, causes irregular to round, small, brown spots on the leaflets. Tiny black fruiting bodies of the causal fungus are found on some of the older spots.

OAK

Anthracnose -- Leaves of infected white oaks have brown dead areas that follow the veins out to the edge of the leaf. Severely affected leaves become curled and twisted, and in wet seasons, leaf fall may be common. Leaves on the lower branches are generally more severely affected than those on the upper branches. The fungus, Gnomonia quercina, may spread into the twigs, forming cankers which may result in twig dieback.

Large Leaf Spot -- In late summer, the causal fungus (Monochaetia desmazierii) infects leaves of white and red oaks, causing circular spots up to 2 inches in diameter. The spots have pale green or yellowish centers and reddish-brown margins. Target-like rings may be formed around the spots as the diseases progresses.

Leaf Blister -- During cool, wet springs, this fungus, Taphrina coerulescens, infects leaves of red and other oaks, and causes circular, raised, wrinkled, yellowish-white areas up to 1/2 inch in diameter on the upper leaf surface. Affected leaves remain attached to the tree and usually continue to function as normal leaves.

Leaf Scorch -- See GENERAL DISEASES

Oak Wilt -- The losses from this disease occur primarily in oak forests along ridge tops in the south central portion of the state and in Allegheny County.

The disease-causing fungus, Ceratocystis fagacearum, invades and plugs the water-conducting system of the tree. The leaves wilt, turn bronze (usually on one or more branches at first), and then fall. Premature shedding of foliage is a visable diagnostic symptom of oak wilt. Infected trees of the red oak group die within a few weeks or may decline slowly over a 2- to 3-year period. Some infected white oaks may recover.

Affected branches develop a brown discoloration in the outer layers of sapwood just under the bark. On the ends of cut twigs, the discoloration may appear as a complete browning of one or more of the outermost annual rings.

The fungus may be carried from tree to tree by various insects. Sap-feeding beetles are of major importance in short-range spread of the fungus. Trees that wilt in late summer or early fall may bear spore-producing mats of the causal fungus under their bark during the folowing spring. As these mats develop, the bark ruptures, exposing the fungus. The odor of the mats attracts sap-feeding beetles which also feed on the fungus and become coated with the sticky spores. If these insects then feed on fresh bleeding wounds on healthy trees, fungus spores are deposited in water-conducting tubes opened by the injury. Research indicates that oak bark beetles which breed under the bark of dying trees and feed on small twigs and branches may be responsible for long-range spread of the fungus.

Susceptibility of oaks to oak wilt -- All tested species of the red oak group are very susceptible and normally die with a few weeks of infection. Although no species of the white oak group is resistant, some species contain resistant individuals. White oak is more resistant than chestnut oak or bur oak. American, Chinese, and European chestnuts, tanbark oak, and bush chinquapin are susceptible.

Twig Canker -- The fungus, Diplodia quercus, infects twigs of chestnut and other oaks, causing a sudden blighting of leaves on occasional twigs and branches. Dead leaves remain attached to twigs and give the tree the appearance of severe locust injury. On trees growing on rocky ridges or suffering from prolonged drought, the fungus may kill large branches or even the entire tree. Fruiting bodies of the causal fungus are found on blighted twigs.

PINE

Needle Blight -- This disease appears on current growth of white pines. From late spring to mid-summer the new needles brown and die back, from the tips downward. The needles are often stunted. The cause of blight is unknown; an inadequate root system, injury to the small feeding roots, or poor soil conditions may be involved.

Needle Cast -- This disease is caused by the fungus Lophodermium pinastri. Scotch pines are susceptible to needle cast. It is particularly severe on the French and Spanish strains of Scotch pine, but also occurs on Austrian, red, and eastern white pines in nursery seed beds.

Infection occurs during the summer on the current year's needles, but no symptoms appear until the following spring when the infected needles turn yellow to brown and fall from the tree. On these fallen needles, the

fungus produces spores which are ejected from fruiting bodies and are carried by wind currents to infect the new needles. Initial infection often occurs on the lower branches of the trees.

Spore production and infection are dependent on abundance of moisture in the form of frequent rains or long-lasting dews. Thus, this disease often appears first next to dense woods where the dew persists or on the lower portions of trees in plantations where weeds have not been controlled. The dense stands of seedlings in seedbeds offer ideal conditions for infection.

Needle Rust -- This rust fungus, Coleosporium asterum, attacks needles of two- and three-needled pines. Red pine is very susceptible. The disease develops in spring as small, cream-colored, bag-like pustules on needles. The pustules rupture, and orange spores are blown to infect goldenrod and asters. The rust overwinters and can live indefinitely in the crowns of these alternate hosts. During summer and autumn, spores from goldenrods and asters infect needles of the pines. This disease may cause needle drop and may stunt young pines, but it seldom causes much damage on older trees.

Tip Blight -- The fungus, Diplodia pinea, causes a tip dieback of branches of Austrian, red, Scotch, and mugho pines. Tiny, black fruiting bodies of the causal fungus grow at the base of diseased needles and on dead twigs and cones.

White Pine Blister Rust -- The rust fungus, Cronartium ribicola, infects and kills needles of white pine and then grows into the bark of twigs and branches. Swollen, oval cankers enlarge to girdle and kill stems and branches. Trees are killed when cankers completely girdle the trunk. Three or four years after infection, yellow spore masses are produced and are carried by wind to infect nearby currants and gooseberries. Rust spores formed on the leaves of these alternate hosts cause new infection of white pines.

PLANE TREE

See SYCAMORE

POPLAR

Cytospora Canker -- The disease-causing fungus (Cytospora chrysosperma) enters the tree through wounds or weakened twigs and kills the twigs back to larger branches on the trunk. Brownish, circular cankers with sunken bark are formed. During moist weather, yellow to reddish threads of the fungus spores are formed and are spread to healthy trees by rain, wind, insects, and birds. Lombardy and Simon poplars are susceptible.

Cyptodiaporthe Canker -- This disease caused by the fungus Cryptodiaporthe populea is especially destructive to Simon and Lombardy poplars. Gray to brown irregular spots are formed on leaves, and the fungus grows down through the leaf stem to form oval to elongate sunken cankers on twigs.

Large trees may survive for several years, but they are disfigured by dead twigs and branches. The Japan poplar shows some resistance.

Leaf Rust -- A rust fungus, Melampsora abietis-canadensis, produces yellowish-orange powdery pustules on the lower leaf surface. Hemlock is the alternate host for this fungus.

Scab or Shoot Blight -- This disease is caused by the fungi, Venturia populina and V. tremulae. Young leaves become black and wilt. In some cases, particularly on quaking aspen, the fungus may spread down the petiole and blacken the shoot, which then withers and appears hooked. Under moist conditions, dark-greenish spores of the fungus are formed on affected leaves and shoots.

REDBUD

Canker -- Sunken oval cankers appear at the base of twigs and branches. These cankers develop when the causal fungus, Botryosphaeria ribis chromogena, enters branches through wounds or dead and dying twigs. The bark becomes blackened in the center of the canker and it cracks around the edges as callus tissue is formed. Severely girdled branches may have sparse foliage or may be killed.

RED CEDAR

See JUNIPER

SMOKE-TREE

Verticillium Wilt -- Olive-brown streaks may be found in wood at the base of affected branches. See GENERAL DISEASES.

SPRUCE

Cytospora Canker -- The causal fungus, Cytospora kunzei, attacks Norway and Colorado spruce, causing death first of the lower branches and then progressing to higher branches. The cankers produced on affected branches are inconspicuous. They may be covered with resin, which often drips to cover lower branches. During rainy weather, thread-like, yellowish, gelatinous spore masses ooze from fruiting bodies on the cankers. These spores are spread by rain, wind, or pruning tools to other spruces, where they enter through wounds.

SYCAMORE

Anthracnose -- This fungus, Gnomonia platani, causes twig, bud, shoot, and leaf blight. Twig blight occurs before leaves appear in the spring, and kills the tips of one year-old twigs. Small black fruiting bodies of the causal fungus appear in the bark of the dead twigs. Cankers may girdle the twigs. Repeated annual killing of twigs results in gnarled or bunchy branch growth.

Bud blight occurs as cankers on the twigs, and causes the buds to die before they open.

Shoot blight, which appears as a sudden dying of expanding shoots and immature leaves on affected branches, is often confused with frost injury. Leaf blight occurs when spores produced on the twig and branch cankers infect expanding or mature leaves. Affected leaves show irregular dead areas along the veins. Dark-brown fruiting bodies of the fungus are found on diseased leaf tissue. The fungus often grows through leaf stems into the twigs, where it becomes active the following spring.

Canker Stain -- This canker disease caused by the fungus Ceratocystis fimbriata f. platani is very destructive to London plane trees. Sycamores also may be affected. Affected trees show sparse foliage in the crown, undersized leaves, and elongated sunken cankers on trunks and larger branches. Beneath the cankers, the wood is stained bluish-black or reddish-brown in a wedge-shaped pattern with the point of the wedge extending into the center of the trunk or branch. The causal fungus enters trees only through injuries, but it is readily transmitted from affected to healthy trees on pruning tools, ropes, ladders, in non-disinfestant wound paints, or by sap-feeding beetles.

Powdery Mildew -- See GENERAL DISEASES

TREE OF HEAVEN

See AILANTHUS

TULIP TREE

Leaf Spot -- The fungus-caused (Gloeosporium liriodendri) leaf blotches have dark-brown borders and may be up to 1/2 inch in diameter.

Leaf Yellowing or Scorch -- During hot, dry periods in mid-summer, leaves of recently transplanted or weakened trees may turn yellow and drop prematurely. Small angular, brownish specks often appear between the veins of affected leaves. The yellowing and scorch result when roots fail to supply enough moisture to replace that lost during hot, dry periods.

Sooty Mold -- See GENERAL DISEASES

WALNUT, BLACK

Anthracnose or Leaf Spot -- The fungus, Gnomonia leptostyla, causes irregular dark-brown spots on leaflets. Severe infection results in premature leaf fall.

WALNUT, ENGLISH OR PERSIAN

Bacterial Blight -- The causal bacterium Xanthomonas juglandis attacks leaves, new shoots, and nuts. Infection appears on young leaves as small, water-soaked spots which become reddish-brown. Severely affected leaves may be twisted and curled. Black sunken lesions may girdle and kill new shoots. Diseased nuts show black sunken lesions on the husks. During wet weather a black, slimy ooze appears on these lesions. Infection of the husks results in premature nut dropping or, if nuts remain attached, in a browning and decay or withering of the kernels.

WILLOW

Crown Gall -- See BIRCH.

Leaf Blight or Scab -- The disease-causing fungus Pollacia saliciperda attacks young leaves, blackening and killing them rather suddenly. New shoots are killed back, and cankers are formed on twigs. The fungus appears along the veins of infected leaves as olive-brown masses in moist weather. Defoliation may be complete. Defoliation for two or three successive years is fatal to the tree.

Black Canker -- The canker fungus, Physalospora miyabeana, causes a disease which is closely associated with scab disease later in the season. Dark-brown spots with concentric markings appear on the upper leaf surface. Whitish-gray cankers with black borders are formed on twigs and smaller branches.

SHRUBS, VINES, AND GROUND COVERS

GENERAL DISEASES

NEMATODES

The nematodes or eelworms which are parasitic on shrubs and vines are generally so small that they can be seen only with the aid of a microscope. These parasitic nematodes feed by means of a hollow spear or stylet which they inject into root cells.

The Northern root-knot nematode penetrates young roots and injects substances into the root cells causing them to enlarge greatly. The resulting galls or root-knots are characteristic of the damage of this nematode.

Meadow or lesion nematodes move about within the roots, feeding on and destroying cells as they go. They enter roots through the cells and injure the root tissue. One species of the spiral nematode partially embed themselves near root tips, feed for a while and then move on to another site. Dagger and stubby root nematodes migrate in the soil and do not normally enter root tissue. They feed only on those cells near the root surface. The feeding activities of the various nematodes often result in brown dead areas which give a flecked appearance to the root. Various decay-causing organisms may enter the roots through these injuries and extensive root rotting may result.

Above-ground symptoms of nematode injury are seldom specific. They may appear as a general decline, but this decline may be confused with symptoms of low fertility or poor drainage. More apparent symptoms are the yellowing, dieback, leaf discoloration, and wilting. Wilting may be especially noticeable during the hot part of the day. (Temporary recovery will be made during the night when more water is absorbed than lost.) Any suspected nematode injury which cannot be diagnosed as such in the field should be confirmed by a laboratory soil test.

POWDERY MILDEW

Fungi of the powdery mildew group infect the leaves of many shrubs and vines, producing patches of white-gray powdery coating on the leaf surface. Tiny, black fruiting bodies of the powdery mildew fungus are often found on the white patches. The disease is often severe in shady, poorly ventilated places.

Shrubs and vines commonly affected with powdery mildew in Pennsylvania are: alder, azalea, bittersweet, Boston ivy, button bush, coralberry, crape-myrtle, euonymous, honeysuckle, hydrangea, lilac, matrimony vine, New Jersey tea, rhododendron, rose, staghorn sumac, trumpetvine, viburnum, Virginia creeper, and witch hazel.

SHOESTRING ROOT ROT OR MUSHROOM ROT

A soil-inhabiting fungus, Armillaria mellea, infects and may kill various shrubs, including azalea, Deutzia scabra, privet, rhododendron, and yew. Affected shrubs show a decline in vigor of all or part of the top. The foliage becomes scant, withers, turns yellow, and drops prematurely.

White, fan-shaped fungus growths are usually found under the loosened bark just below the soil level. Brown or black, root-like "shoestrings" of the causal fungus are often found in the soil near the roots and under the bark of affected shrubs. They can grow through the soil and penetrate and cause infection of the roots of other susceptible shrubs.

When one of these "shoestrings" is split open, the inside resembles a mass of white compressed cotton. They are rather brittle, and where they cross each other, they fuse or grow together. In the fall, clusters of honey-colored mushrooms are often found growing around the base of affected shrubs. The mushrooms produce spores which can start infection through wounds near the base of nearby shrubs.

DISEASES OF SPECIFIC PLANTS

AJUGA, BUGLE-WEED

Crown Rot -- The causal fungus, Sclerotium delphinii, enters the roots and crowns of ajuga plants during warm, humid periods in the spring and causes wilting and death of the plants.

ALDER

Catkin Galls -- The causal fungus, Taphrina robinsoniana, makes the scales of the female catkins swollen and distorted. They develop into curled, reddish, tongue-like outgrowths.

Powdery Mildew -- See GENERAL DISEASES

ALMOND, FLOWERING

Blossom and Twig Blight -- The fungus Monilinia fructicola blights blossoms and attacks leaves and twigs which turn brown and die. The dead portions usually are covered with masses of powdery brown spores. This fungus also causes blossom blight and brown rot of stone fruits.

AZALEA

Angular Leaf Spot -- This fungus, Septoria azaleae, causes small yellow spots on the leaves. The spots enlarge and become brown in the center. A definite ring around the spot is formed. In some varieties the ring is bright red and in others it has the brown color of the spot. Infected leaves fall prematurely. Pinpoint-like black fruiting bodies of the fungus develop on the fallen leaves. The fungus overwinters on the plants and on fallen leaves on the ground. It is spread by splashing water and needs moist weather for infection. The variety Hinodegiri is the most susceptible.

Bud and Twig Blight -- The causal fungus Briosia azaleae infects flower buds in the spring. The bud scales turn silvery gray. In the summer, flower and leaf buds become dwarfed to half size, turn light brown, and shrivel. Tips of the lower bud scales project outward in a rosette. Infection of leaf buds on the side of the twigs usually kills the twigs. Small black fruiting bodies of the fungus appear on buds the spring after a summer infection. Repeated infection of the buds may kill the shrub in two to three years.

Cutting Rot -- This disease is caused by the soil-borne fungus Rhizoctonia solani. Symptoms appear as a rot at the base of cuttings. Under humid conditions, brown fungus strands may grow from plant to plant over the leaves and stems causing a leaf and stem rot.

Damping-Off -- Several soil-inhabiting fungi attack seedlings of azalea and rhododendron. Poor stands result when the seedlings decay before the cotyledons have pushed away from the seed coat, and later when tender stems rot at the soil line and the seedlings die.

Leaf and Flower Gall -- An air-borne fungus, Exobasidium vaccinii, causes the leaves and flowers of azaleas and Rhododendron maximum and R. catawbiense to become thickened into fleshy, bladder-like, pale green or pinkish galls. As the galls mature, they turn brown and hard.

Leaf Spots (non-parasitic) -- Brown spots on the foliage of azaleas or rhododendrons often result from sunscald, drought injury, or winter injury. They appear as a pattern of somewhat circular areas around the edges or on the tips of leaves, or as long dead areas on either side of the middle vein. A weak airborne parasite then gains entrance to the plant through injured tissue, and causes silver-gray spots on the upper leaf surface and light-brown spots on the lower leaf surface. The upper surface may be thickly dotted with black fruiting bodies of the fungus. During wet weather, spores may ooze out in thread-like tendrils or as black droplets.

Leaf Spots -- Small, distinct yellow spots occur on the foliage of some varieties of azalea.

Petal Blight -- The causal fungus Ovulinia azalea attacks flower only, starting as a spotting of the petals. After the spotting, the flowers collapse, turn brown, and may be rather slimy. They remain hanging on the plants long after unaffected flowers have died and fallen off. An outbreak of the disease during wet, humid weather may cause the death of practically all flowers on a plant.

The fungus overwinters on or slightly below the soil surface around the azalea plants. In the spring, small saucer-shaped structures are raised above the soil on slender stalks. Microscopic spores are shot into the air from these structures and are carried by wind currents to the flowers where infection takes place.

Powdery Mildew -- See GENERAL DISEASES

Rust -- The rust fungus, Pucciniastrum vaccinii, may cause severe defoliation of hybrid deciduous azaleas. It is reported that in some states, the fungus may kill seedlings of Rhododendron ponticum. The disease appears on the underside of the leaves as bright orange spore-producing pustules. New rust infection of azaleas in the spring may come from overwintering spores on rhododendrons or from hemlock, the alternate host necessary for the completion of the life cycle of the rust.

BARBERRY

Bacterial Leaf Spot -- A bacterium, Pseudomonas berberidis, causes small, irregular spots on the leaves. The spots are dark green and water-soaked at first but later become purplish-brown. When young twigs are infected, the buds may not develop the next spring. If they are girdled, the entire twig is blighted.

Rust -- The causal fungus, Puccinia graminis, attacks European barberry and other varieties with sawtooth-edged leaves. Japanese barberry is immune, but crosses of Japanese and European barberries may be susceptible.

The fungus causes a bright-orange spotting on the leaves in the spring. From these spots come spores which infect wheat, oats, rye, barley, and some grasses. The disease rarely does much damage to the barberry shrub. In Pennsylvania it is unlawful to grow rust-susceptible varieties of barberries.

Wilt -- Verticillium albo-atrum, the fungus that causes wilt, lives in the soil and apparently enters the plant through injured or healthy roots. Leaves of affected plants turn yellow or red, followed by browning and premature defoliation. The sapwood of affected stems and roots is streaked with reddish-brown lines. Older infected wood shows a brownish-green discoloration.

BAYBERRY

Rust -- Bright-orange pustules caused by a fungus (Gymnosporangium ellisii) are usually found on the underside of the leaves.

BITTERSWEET

Powdery Mildew -- See GENERAL DISEASES

BOXWOOD

Decline, Dieback -- Decline or dieback often follows winter injury or occurs on plants that are growing in a poorly-drained soil. Nematodes may be associated with this trouble. In spring, the foliage of affected plants changes from the normal dark green to gray-green or bronze and finally to a straw color. Shoot growth is weak and old leaves drop prematurely. Entire branches die, especially those in the middle or top of the plant. Sunken areas or cankers may occur in the bark of the trunk just above the ground line or on the branches in the crotches where dead leaves and debris accumulate. The bark on the sunken areas may be brown or streaked with brown and may peel or split away from the gray to black discolored wood beneath.

Leaf Spot -- This leaf spot is limited to leaves weakened from winter injury and other causes. Infected leaves are straw-yellow, and they are dotted with small black fruiting bodies of the causal fungus (Macrophoma candollei).

Nematode Injury -- This injury appears as a bronzing of the leaves, stunting of growth, and general decline of the shrub. It results when meadow nematodes (Pratylenchus sp.) enter the roots, usually near the tip, and feed on the cell contents. Affected roots may die or may show small, brown, dead areas which give roots a flecked appearance. New roots often form above the injured area and are invaded by the nematodes. Repeated growth of new roots and their invasion by the nematodes results in the formation of bundles of lateral rootlets which may eventually give the root system the appearance of a witch's broom. In extreme cases it is difficult for water to penetrate the mass of roots.

Various other parasitic nematodes have been observed feeding on the roots of boxwood, but usually not in large numbers.

BUCKTHORN

Rust -- The rust (Puccinia coronata) appears as small, orange spots on the leaves of buckthorn. It causes little injury to the shrub, but the disease spreads to oats, causing the oat crown rust which often is destructive. Buckthorn should not be grown in oat-producing areas.

BUTTONBUSH

Leaf Spot -- Several fungi cause small brownish or black areas on the leaves.

Powdery Mildew -- See GENERAL DISEASES

CHERRY, HANSEN'S BUSH

Brown Rot -- The rot fungus, Monilinia fructicola, blights blossoms and also attacks leaves and twigs which turn brown and die. Dead portions usually are covered with masses of powdery spores of the causal fungus.

CHOKEBERRY

Rust -- The fungus Gymnosporangium fraternum infects leaves, stems, and fruit, causing galls which bear spores in short tube-like projections. The spores infect the alternate host, the southern white cedar.

Twig and Fruit Blight -- The causal fungus, Monilinia fructicola, blights the blossoms and also attacks the leaves and twigs which turn brown and die. The affected portions usually are covered with masses of powdery, brown, fungus spores.

CLEMATIS

Stem Rot and Leaf Spot -- This fungus (Ascochyta clematidina) attacks plants near the soil line and extends down the stems, girdling them, and causing the upper parts to wilt and die. Spots rarely appear on the leaves outdoors, but when the plant is grown indoors, small water-soaked areas develop. These spots later become buff-colored and are surrounded by a reddish ring. Infection may occur from spores borne in fruiting bodies on stubs of old stems.

Leaf Spot -- The fungus Cylindrosporium clematidis causes irregular reddish-brown spots that appear on the lower leaves. Infected leaves may fall.

COTONEASTER

Fireblight -- The bacterium Erwinia amylovora attacks flowers and leaves near the growing tips causing a wilting and blackening of the leaves. The black blighted twigs with dead persistent leaves appear as if they were scorched by fire. Cankers with split edges form at the base of affected twigs. The causal bacteria overwinter near the edge of the cankers and ooze to the surface during wet weather at bloom period. Splashing water and insects spread the bacteria to blossoms and wounds to start new infections.

DAPHNE

Nectria canker -- The disease is caused by the fungus Nectria cinnabarina. Fungus-infected twigs have rough cankers which are covered with many small, reddish fruiting bodies.

Stem and Root Rot -- The fungus, Phytophthora parasitica, attacks rooted cuttings and established plants causing dark-brown to black irregular areas on the stems at or near the ground line. These areas may grow together and girdle the stem. Roots of affected plants become water-soaked and blackened.

DUTCHMANS-PIPE

Leaf Spots -- Several fungi cause circular and angular brown areas on the leaves.

EUONYMOUS

Crown Gall -- A bacterium, Agrobacterium tumefaciens, causes rounded galls with irregular rough surfaces on the stems or roots. The bacteria enter through wounds made during cultivation. Euonymous fortunei radicans, E. f. vegetus, E. patens are susceptible to this disease.

Powdery Mildew -- See GENERAL DISEASES

FIRETHORN

Fire Blight -- This bacterium causes a sudden wilting, dying, and browning or blackening of new shoots. Leaves on these shoots die, hang downward, and cling to the blighted twigs. The variety Pyracantha koidsumii is susceptible, and P. crenulata is moderately susceptible to this disease. P. coccinea lalandii is relatively resistant.

Scab -- Dark, velvety, sooty areas on the leaves turn yellow, then brown, and drop prematurely. The fungus, Fusicladium pyracanthae, infects the berries, spoiling their appearance with a black, sooty, scab-like discoloration which may spread over half or more of the berry surface. Affected berries are often badly shriveled. The Laland firethorn, Pyracantha coccinea lalnadii, is susceptible to this disease while the Yunnan firethorn, P. crenato-sessata, is usually very resistant.

FORSYTHIA, GOLDEN BELL

Stem Gall -- This fungus (Phomopsis sp.) causes small nodular galls along the stems. The galls may become numerous enough to kill the branches.

HOLLY

Leaf Rot or Leaf Drop -- The disease fungus, Rhizoctonia solani, may cause severe defoliation of holly cuttings. The fungus is found in contaminated sand or on the boards of the cutting bench; it enters the cutting through leaves that touch the sand. The disease first appears as a cobweb-like growth on the leaves, a combination of the fungus threads and grains of sand sticking to the underside of leaves that touch the sand. Leaf drop usually begins 2 to 3 weeks after the cuttings are set. In some cases, target-like spots from 1/4 to 1/2 inch in diameter are found on the leaves.

Leaf Scorch (non-parasitic) -- Circular or irregular, light tan spots up to 3/4 inch in diameter appear on the leaves in the early spring or during the summer. The spots are often covered with tiny, black fruiting bodies of fungi. These spots are caused by sun scalding during the winter or summer. Many occur during the summer when a sudden rain shower is immediately followed by bright sunlight. The presence of ice on the leaves often results in a similar scalding in the winter. The fungi which often are found on the spots are of a secondary nature and do not spread to the living leaf tissue.

Spine Spot (non-parasitic) -- Grayish-brown spots ranging from the size of a pinhead to that of a pea often appear on leaves during late winter and early spring. These spots may appear on either surface of the leaves and in most cases are surrounded by a purple halo. They are the result of the wounding of the leaves by the spines of nearby leaves during windstorms. Occasionally, black fruiting bodies of a fungus may be found near

the center of the spots, but these fungi are secondary, since they come after the leaf tissue was wounded.

Tar Spot -- The fungus, Phacidium curtisii, causes small, yellow spots on leaves in early summer. The spots enlarge through the summer and turn reddish-brown. They are surrounded by a narrow, yellow border. In the fall, flat, black, cushion-shaped masses of the causal fungus develop just beneath the leaf surface. The leaves do not fall, but the diseased area drops out.

HONEYSUCKLE

Powdery Mildew -- See GENERAL DISEASES

HYDRANGEA

Bacterial Wilt -- This bacterium, Pseudomonas solanacearum, infects flowers and young leaves of tree hydrangeas. It causes them to wilt and turn brown. During wet, hot weather, the disease may become so severe that plants are killed.

Gray Mold Blight -- During wet seasons, the causal fungus, Botrytis cinerea, may cover dense clusters of flowers with a gray mold. On Hydrangea opuloides, the appearance of this mold is common after frost injury.

Leaf Spot -- This fungus, Phyllosticta hydrangeae, causes brown spots on the leaves, usually near the margins. In severe cases, both leaves and blossoms may be killed.

Powdery Mildew -- The causal fungus covers the undersides of the leaves with a light gray mold which turns brownish in patches. The upper surfaces may remain green or turn purplish-brown. The leaves die prematurely and blooms are stunted or spotted. The buds of certain varieties may be badly deformed.

Rust -- A fungus, Pucciniastrum hydrangeae, causes large numbers of rusty-brown pustules on the leaves. Severely infected leaves dry up and become brittle.

IVY, BOSTON AND VIRGINIA CREEPER

Leaf Spot -- This leaf-spot fungus, Guignardia bidwelli f. parthenocissi, causes angular, reddish to gray-brown leaf spots. They usually are dark brown at the margin with tiny, black fruiting bodies of the causal fungus on the spot's surface. The plant may die back and lose its leaves after severe infection.

Powdery Mildew -- See GENERAL DISEASES

IVY, ENGLISH

Bacterial Leaf Spot -- A bacterium Xanthomonas hederae infects the leaves causing small, light green, water-soaked spots. The spots later enlarge and turn brown or black with reddish-purple margins. The leaf stalks become black and shriveled. A black decay may extend from the tip of the twigs downward into the old wood, and cankers may girdle the stems. Under warm, moist conditions a bacterial ooze may be present on the stem cankers.

Leaf Spot and Stem Spot -- This fungus, Phyllosticta concentrica, causes oval or circular brown spots about 1/2 inch in diameter on both surfaces of the leaves. Tiny, black fruiting bodies of the fungus may be scattered over the surface of the spots. The fungus may infect and girdle stems and cause them to collapse and die.

KERRIA

Leaf and Twig Blight -- A fungus, Higginsia kerriae, infects the leaves causing small, irregular discolored areas which become light to reddish-brown with darker borders. When the spots are numerous, the leaves turn yellow, shrivel, and fall prematurely. On the stems, the lesions are circular, reddish-brown to black spots which often run together into extended cankers. In the cankers, the bark splits to allow masses of white spores to ooze out of the tiny, black fruiting bodies. Dieback of twigs may follow severe stem infections.

The fungus causing the disease overwinters in dead leaves and in cankers on diseased stems.

Twig Blight -- This fungus, Phomopsis japonica, causes oval or long, irregular, tan-colored spots with slightly raised edges on the main stems. Groups of tiny, black fruiting bodies of the causal fungus may be found in these spots. Twigs and leaves on infected stems may become brown and blighted.

LAUREL, MOUNTAIN

Leaf Spot -- The fungus Mycosphaerella colorata infects the leaves causing irregular, circular, grayish-white or silvery spots with a red to purple border. The spots at first are red and small. They later enlarge to about 1/8 to 1/4 inch in diameter. The tiny, black fruiting bodies of the fungus are found on the central, grayish area of the spots. Where the disease is severe, leaves may fall. The disease usually is most severe when the shrubs are crowded or partly shaded.

Leaf Blight -- This fungus (Phomopsis kalmiae) infection of the leaves causes circular, brown, zonate areas which gradually enlarge, run together, and eventually may involve the entire leaf blade. The fungus may attack the leaf-stem and grow into the branch where it causes a twig-blight. This disease is distinguished from leaf spot by the zoned areas within the blight spots, by the absence of the silvery center, and by the larger size of the spots. Leaf blight usually is most severe when the shrubs are in the open.

LEUCOTHOE

Leaf Spots -- Several fungi cause a spotting of the leaves of leucothoe. These spots vary in shape and range in size from 1/16 to 1/2 inch in diameter. They may be covered with the small, black fruiting bodies of the causal fungus.

LILAC

Bacterial Blight -- A bacterium, Pseudomonas syringae, infects the leaves causing brown to black spots which may cover the whole leaf. Bacteria may enter the twigs directly or pass from blighted leaves into the twigs. When girdling takes place, the shoot turns black; the black, dry leaves cling to the twig. Flower buds become blackened and flower clusters may become limp and dark brown. The bacteria overwinter in diseased twigs. The disease is most severe during moist, mild weather and appears as the young shoots develop. White-flowered varieties are more susceptible to the disease than varieties with colored flowers.

Leaf Blights -- Two fungi, Cladosporium herbarum and Heterosporium syringae, affect the leaves causing large gray-brown blighted zonate areas. The affected areas are often covered with a velvety olive-colored bloom. The diseased leaf tissue may crack and fall away, giving an irregular appearance to the leaves.

Powdery Mildew -- See GENERAL DISEASES

Shoot Blight -- This fungus, Phytophthora cactorum, causes symptoms which are similar to those of bacterial blight except that the diseased stem areas are dark brown instead of black and that killing of the shoots is more extensive. Blossoms and tender growing tips are blighted and turn brown. The shoots may be killed back 4 to 5 feet. Root sprouts that come up under the shrubs often are killed.

MAHONIA, OREGON GRAPE

Leaf Spot -- Several species of the Phyllosticta fungus cause spots on the leaves or may be found growing on the dead areas of leaves which have been injured by winter weather conditions. Tiny, black fruiting bodies of the fungus appear on the affected areas.

MATRIMONY VINE

Powdery Mildew -- See GENERAL DISEASES

MOCK ORANGE

Leaf Spot -- A fungus, Ascochyta philadelphi, causes brown, circular spots on the leaves.

NEW JERSEY TEA

Powdery Mildew -- See GENERAL DISEASES

PACHYSANDRA

Leaf and Stem Blight -- The causal fungus Volutella pachysandra infects the leaves and stems with large brown to black areas on which pink spore masses are formed during wet weather. The disease is likely to be severe on crowded plants or in locations where the plants have been kept too moist. The disease may spread rapidly on injured plants.

PERWINKLE, GROUND MYRTLE

Blight -- During the wet weather of May and June, the fungus Botrytis cinerea may attack the leaves causing brown or black spots which in most cases extend inward from the edge of the leaf. The spots may appear as circular areas up to 3/8 inch in diameter or may involve the whole leaf.

Canker and Dieback -- This disease which usually appears during the rainy periods of late May and early June, and again during the rainy periods of the fall, is caused by the fungus Phomopsis livella. Shoot-tips of affected plants wilt, become dark brown, and die. Tiny black fruiting bodies of the causal fungus are often found on the affected stems. A soil-inhabiting fungus may rot the roots and lower stems. Shoot-tips of affected plants may wilt and die as the result of the rotting of the roots and lower stems, and the disease may be confused with canker disease; the two diseases may be found in the same planting of periwinkle.

PRIVET

Anthracnose, Canker, or Twig Blight -- Common or European privet and Lodenese privet are especially susceptible to this fungus-caused disease. Resistant varieties are Amur, Ibota, Regal, and California. Leaves on affected branches dry out and cling to the stem. Twigs are blighted. Cankers dotted with pinkish fruiting bodies of the causal fungus, Glomerella cingulata, are formed at the base of the main stems. The bark and wood of diseased portions becomes brown and splits. Affected plants die when the stems are completely girdled.

Galls -- A fungus, Phomopsis sp., causes nodular galls up to 6 inches long and 1 1/2 inches in diameter on the stems of common privet.

Powdery Mildew -- See GENERAL DISEASES

QUINCE, JAPANESE FLOWERING

Fire Blight -- The causal bacterium infects the flowers, severely blighting them, and gives the shrub the appearance of having been injured by frost. Blight of the twigs is rare.

RED-OSIER DOGWOOD

Botryosphaeria canker -- This fungus, Botryosphaeria ribes, attacks the branches causing light-tan, irregular cankers from 1 to 8 inches long. Affected branches may die or be weakened so that they break under the weight of heavy snow.

RHODODENDRON

Damping-Off -- See AZALEA

Leaf and Flower Galls -- See AZALEA

Leaf Spots -- The fungus Gloesporium sp. may cause a severe leaf spotting of hybrid rhododendrons. Lee's Dark Purple is especially susceptible. The circular to irregular spots are light tan with a dark-brown border. Black, pinpoint fruiting bodies of the causal fungus appear target-like in the spots.

Another fungus, Cercospora rhododendri, causes angular dark-brown spots on the leaves of R. ponticum. The disease is most severe on the lower leaves of young stock.

Two species of the Phyllosticta fungus cause similar leaf spots, which are either marginal or at the tips of the leaves. The dark-brown, zonate, dead areas often cover half of the leaf.

An air-borne fungus, Exobasidium burtii, causes small, distinct, yellow spots on the foliage of R. ponticum and on some azaleas.

Powdery Mildew -- See GENERAL DISEASES

Twig Canker and Dieback -- This fungus, Phytophthora cactorum, causes water-soaked areas at the base of the leaves of hybrid rhododendrons growing in shady moist locations. These areas become brown, zoned, silvery-white spots on the upper leaf surface, and a light, chocolate brown below. Affected terminal buds and leaves turn brown and the leaves roll up and droop as they do during cold winter weather. On tender new growth, dark-brown sunken cankers appear, which extend down the stem. Cankers formed on older tissues may girdle and kill the infected branches. The fungus advances down the stem often killing the entire plant. The normal browning or hardening-off of young twigs is sometimes confused with dieback. Twigs on normal rhododendron plants turn brown from the basal portion upward every year. The dieback disease causes twigs to brown from the tip downward.

Wilt -- A soilborne fungus, Phytophthora cinnamomi, enters the young roots of R. ponticum, hybrid seedlings, and grafted plants and works its way up to the crown. At first, single branches may yellow and wilt, after which the entire plant may become affected. The wilt disease may be diagnosed by scraping a section of bark from the main stem of the plant near the soil line. Reddish streaks in the wood are an indication of the presence of the wilt fungus.

The disease is most destructive in cool locations in the seedbed or nursery where the soil is not acid enough for good growth of rhododendrons. The injured roots of recently transplanted seedlings are weak spots where fungus may enter. Infection also may take place at the soil level through growth cracks which often occur during the second year's growth of seedlings.

SERVICEBERRY, SHADBUSH

Rust -- The causal fungus Gymnosporangium nidus-avis, infects the leaves with brownish-orange spots up to 1/4 inch in diameter. In the spring during wet weather, light-colored spore horns are formed on the fruit and on the spots on the leaves. Spores from these horns infect nearby red-cedars, the alternate host necessary for the completion of the life cycle of the rust fungus.

Witches' Broom, Black Mildew -- This fungus, Apiosporina collinsii, causes a stimulation of the growing point of the plant which gives rise to the development of many new shoots with the appearance of a broom. There usually is a heavy coating of black mold on the under surface of the leaves.

SNOWBERRY

Spot Anthracnose -- The fungus Sphaceloma symphoricarpi causes small, dark-purple or black spots with gray centers on the leaves in the early spring. Leaves may become distorted because of spots which become established along the edges while the leaf is developing. Stems may become distorted and abnormal. Spotting of flowers is inconspicuous, but purple areas that become sunken and pinkish may appear on the berries which eventually shrink and dry.

Anthracnose -- The fungus Glomerella cingulata infects the berries causing cinnamon-colored spots. The berries then become black, rough, mummified, and fall prematurely.

Berry Rot -- A fungus Alternaria sp. causes the berries to turn yellowish or brown and develop a soft, watery rot. Bud scales and bark also may become infected.

STAGHORN SUMAC

Fusarium Wilt -- This fungus, Fusarium oxysporum f. rhois, causes a wilting of the leaves which hang sharply downward from the twigs and may remain attached to the stem. Affected branches have a brown discoloration in the wood just beneath the bark. The wilting may be gradual, in which case dwarfing,

yellowing, and premature autumn coloration may appear first. Wilting may be followed by the death of the plant.

Powdery Mildew -- See GENERAL DISEASES

SWEET FERN

Rust -- The causal fungus, Cronartium comptoniae, develops on the underside of the leaves where long, brown, thread-like spore horns extend out from the surface. Spores live over the winter and infect some two- and three-needle pines. The disease does little damage to sweet fern but may cause killing of the pine alternate host.

TRUMPET VINE

Powdery Mildew -- See GENERAL DISEASES

VIBURNUM

Bacterial Leaf Spot -- The bacterium, Pseudomonas viburni, causes circular water-soaked spots on the leaves and irregular, sunken, brown cankers on young stems. The causal bacteria live over in the cankers or in the buds. Arrow-wood viburnum, V. dentatum, double file viburnum, V. tomentosum, and European cranberrybush, V. opulus, are susceptible to this disease.

Powdery Mildew -- The causal fungus covers the foliage with a white coating of mildew during late summer and fall.

WITCH HAZEL

Leaf Spot -- The fungus Phyllosticta hamamelidis infects the leaves creating small spots which grow large to reddish-brown blotches causing considerable leaf dropping.

Powdery Mildew -- See GENERAL DISEASES

ORNAMENTAL AND SHADE TREES
DISEASE CONTROL MEASURES

GENERAL DISEASES

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
LEAF SCORCH	Fertilize trees low in vigor. During dry periods, supply water to recently transplanted trees.		
POWDERY MILDEW	(Mildew is often more unsightly than harmful.)	benomyl 50% WP, 1/2 pound per 100 gallons	Spray weekly.
SOOTY MOLD			Control the insects responsible for secreting the honeydew.
VERTICILLIUM WILT	Plant clean stock on land where susceptible crops have not been grown. Avoid wounding roots. Destroy severely affected plants. Trim affected parts from less severely attacked plants; disinfest tools between cuts. If replanting is necessary, remove all soil from the entire root area and replace it with uninfested topsoil. Fertilize. Maintain N-P-K balance in soil. Avoid high nitrogen fertilization.		Control plant parasitic nematodes. Soil fumigation for the sole purpose of Verticillium control is a questionable investment.

SPECIFIC DISEASES

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
AILANTHUS			
Verticillium Wilt	See GENERAL DISEASES		
ARBORVITAE			
Twig Blight	Prune and destroy diseased twigs and branches. Plant resistant varieties. Take cuttings from healthy plants.		
ASH			
Anthracnose	Gather and compost leaves from affected trees.		
Leaf Scorch	See GENERAL DISEASES		
Rust	(Not usually severe enough to justify control measures.)		
BEECH			
Leaf Mottle or Scorch	If valuable trees have been defoliated, wrap exposed branches with burlap to protect them from the sun until the second set of leaves develops. Provide adequate fertilization.		
BIRCH			
Crown Gall	Destroy affected young trees and nursery stock. Do not replant with willow, poplar, chestnut, sycamore, maple, walnut, or fruit trees. Avoid wounding stems and roots of healthy trees.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
BLACK LOCUST			
Broming Disease	Remove and destroy affected trees.		
BUTTERNUT			
Dieback	Destroy severely affected trees. If infection is light, remove diseased branches; prune back to sound wood.		
Anthracnose	Gather and compost leaves from affected trees.		
CATALPA			
Leaf Spots	Gather and compost leaves from affected trees.		
Powdery Mildew	See GENERAL DISEASES		
Verticillium Wilt	See GENERAL DISEASES		
CHESTNUT			
Blight	(No effective control is available for chestnut blight.)		
Leaf Spot	Compost diseased leaves in the fall.		
Twig Canker	Plant in sites with good air drainage. Protect trees from injury. Prune affected branches 1 to 2 feet below cankers. Do not leave stubs when pruning.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
CRABAPPLE, FLOWERING			
Cedar-Apple Rust	Do not plant crabapple trees within one mile of red cedar or other juniper trees. In late winter, remove galls from nearby junipers.	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray 3 times at 10-day intervals, beginning when flower buds open.
Fire Blight	Avoid overfertilization. From December to February, cut out infected branches and twigs, at least a foot below the edge of the cankered bark.	streptomycin compound, 100 parts per million	Spray when 20 percent of the blossoms are open; repeat in 5 days.
Scab	Rake and compost leaves in the fall.	folpet 50% WP, 1 1/2 pounds per 100 gallons	Apply first spray when ½ inch of green leaf tissue shows on the flower buds; continue once a week until the petals have fallen.
Powdery Mildew	See GENERAL DISEASES		
DOGWOOD			
Crown or Trunk Canker	Avoid wounding the trunk during transplanting and mowing. If trunk is injured, trim back bark around wound, shape to a point at top and bottom. Paint edges of wounds with shellac. Cut out infected area of small cankers. Destroy trees with large cankers; do not replant the area with dogwoods for several years.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Flower and Leaf Blight	(This disease generally disappears in dry weather.)	benomyl 50% WP, ½ pound per 100 gallons	Spray at mid-bloom when extremely humid weather occurs during bloom.
Leaf Scorch	See GENERAL DISEASES		
Leaf Spot		zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray if the disease has been severe in the previous year.
Powdery Mildew	See GENERAL DISEASES		
Spot Anthracnose		zinc ion-manganese coordination product 1 1/2 pounds per 100 gallons	Make first application as soon as flower buds have opened to cup stage. Repeat applications monthly through the summer until new flower buds are formed.
Twig Blight	Prune dead twigs back to sound wood. Fertilize to imporve vigor. Water during dry periods.		
ELM			
Black Leaf Spot	Rake and compost old leaves before the buds break.	8-8-100 bordeaux	Spray when the leaves are unfolding, again when leaves are full-sized, and again two weeks later.
Dothiorella Wilt	Prune and destroy infected branches; cut at least a foot below any evidence of brown streaking in the wood. Fertilize trees low in vigor.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	Notes
Dutch Elm Disease	See page 63		
Leaf Scorch	See GENERAL DISEASES		
Phloem Necrosis	(No control is available for this disease.)		
Sooty Mold	See GENERAL DISEASES		
Verticillium Wilt	See GENERAL DISEASES		
Wetwood	Drill hiles into infected wood to relieve pressure and to prevent toxic sap from being carried into the branches. Drill holes 6 to 14 inches below the fluxing area; slant holes upward into heartwood. Screw a short piece of pipe into the hole to carry sap clear of the tree. Hasten healing of wounds by removing bark around wound to form a vertical oval.		
HACKBERRY			
Witches' Broom	If the brooms are unsightly, cut them off.		
HAWTHORN			
Fire Blight	Do not overfertilize. From December to February, cut out infected branches and twigs at least a foot below the edge of the cankered bark.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Leaf Spot		zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray when new leaves unfold, and once or twice again at 10-day intervals. Additional applications may be necessary during wet seasons.
Leaf Blight and Fruit Rot	Rake and compost fallen, mummified fruit.		
Rust	Do not plant red cedars or other junipers near hawthorn plantings	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray first as flower buds open, and twice again at 10-day intervals.
HEMLOCK			
Twig and Branch Canker	Avoid injuries to tree. Prune diseased branches back to nearest living lateral, or to the trunk of the tree. Prune only in dry weather.		
HICKORY			
Leaf Spot	Gather and compost fallen leaves in fall to reduce chance of spring infection.	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray valuable trees 2 to 4 times at 10- to 14-day intervals; start soon after buds open.
HORSE CHESTNUT			
Leaf Blotch	Gather and compost fallen leaves in fall to reduce chance of spring infection.	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray when terminal shoots are 6 to 8 inches long. Repeat 2 to 4 times at 10- to 14-day intervals.
Leaf Scorch	See GENERAL DISEASES		
Powdery Mildew	See GENERAL DISEASES		
JUNIPER, RED CEDAR			
Rusts	If only a few trees are infected, hand-pick galls in the spring, before spore horns appear.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Twig Blight	See ARBORVITAE		
LINDEN, BASSWOOD			
Anthracnose or Leaf Blotch	Gather and compost leaves in fall to reduce chances of spring infection.		
Leaf Scorch	See GENERAL DISEASES		
Leaf Spot	Same as for anthracnose		
Powdery Mildew	See GENERAL DISEASES		
Sooty Mold	See GENERAL DISEASES		
Verticillium Wilt	See GENERAL DISEASES		
MAGNOLIA			
Powdery Mildew	See GENERAL DISEASES		
Sooty Mold	See GENERAL DISEASES		
MAPLE			
Anthracnose	Destroy fallen leaves.	4-4-100 bordeaux	Spray in the spring when the leaves are about half grown; follow with 2 or 3 applications at 2-week intervals.
Bleeding Canker	Slightly infected trees may recover without any special treatment. No cure exists for severely affected trees.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Leaf Spot	Destroy fallen leaves.		Spray as for anthracnose.
Leaf Scorch	See GENERAL DISEASES		
Sooty Mold	See GENERAL DISEASES		
Tar Spot	Rake and compost fallen leaves.		Spray as for anthracnose.
Verticillium Wilt	See GENERAL DISEASES		
MIMOSA			
Wilt	Destroy infected trees.		
MOUNTAIN ASH			
Cytospora Canker	Prune infected branches. Fertilizing will help trees that are not affected seriously, but it may increase the susceptibility to fire blight if high-nitrogen fertilizers are used.		
Fire Blight	Do not overfertilize. From December to February, cut out infected branches and twigs at least a foot below the edge of the cankered bark.		
Leaf Spot			(The disease usually does not cause enough damage to justify the cost of spraying.)

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
OAK			
Anthracnose		zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray once when leaf buds are opening.
Large Leaf Spot	Compost infected leaves in fall.		
Leaf Scorch	See GENERAL DISEASES		
Oak Wilt	See page 64		
Twig Canker	When practical, prune infected twigs back to healthy wood.		
PINE			
Needle Blight	Fertilize and water adequately.		
Needle Cast		maneb plus zinc fungicide, 1 1/2 pounds per 100 gallons	Where disease has been severe, spray first in late July, and continue at 14-day intervals. In seedbeds, begin spraying in early July and continue at 14-day intervals until late September.
Needle Rust	Destroy goldenrod and asters near valuable pine plantings or nurseries.		
Tip Blight	Remove and destroy all affected twigs.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
White Pine Blister Rust	Remove European black currants within a mile around white pine. Remove all wild currants and gooseberries within 900 feet, and all cultivated red currants within 200 feet. When valuable trees become infected, prune dead and dying branches close to the trunk. On large branches, cut out established cankers 4 inches above and below, and two inches to either side of the discolored bark of the canker.		
PLANE TREE	See SYCAMORE		
POPLAR			
Cytospora Canker	Fertilize and water adequately. Prevent wounds on twigs and limbs. During dry weather, prune affected limbs and cut out cankers.		
Cryptodiaporthe Canker	Remove badly infected trees. Prune affected branches and remove cankers as for Cytospora Canker.		
Leaf Rust	Grow poplars at least 100 yards from hemlocks.		
Scab or Shoot Blight	(No practical control is known.)		
REDBUD			
Canker	Avoid wounding trees. Prune severely affected branches. Fertilize in the spring.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
SMOKE TREE			
Verticillium Wilt	See GENERAL DISEASES		
SPRUCE			
Cytospora Canker	Fertilize. When trees are completely dry, prune all diseased branches back to the trunk or to nearest lateral branch.		
SYCAMORE			
Anthracnose		dodine 65% WP, 1 pound per 100 gallons or zineb 75% WP, 2 pounds per 100 gallons	Spray at budbreak and again 10 to 14 days later. Spray at budbreak and again 10 to 12 days later.
Canker Stain	Avoid injuring trees. Remove and destroy infected trees. Prune during the winter. Disinfest tools and equipment after use on each tree. (For tools and ladders, use 70 percent denatured alcohol. Enclose ropes for 3 hours in a 10-gallon container with 1/4 pound formaldehyde.)		
Powdery Mildew	See GENERAL DISEASES		
Tree of Heaven	See AILANTHUS		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
TULIP TREE			
Leaf Spot	Compost infected leaves.		
Leaf Yellowing or Scorch	Supply water during dry periods.		
Sooty Mold	See GENERAL DISEASES		
WALNUT, BLACK			
Anthracnose or Leaf Spot		dodine 65% WP, 1 pound per 100 gallons	Spray when first leaves are half-grown; make three more applications at 14-day intervals.
WALNUT, ENGLISH OR PERSIAN			
Bacterial Blight		fixed copper solution containing 50% metallic copper, 4 pounds per 100 gallons	Spray when female flowers appear, again when 50 percent of the female flowers are in bloom, and again when female flowers have ceased to bloom.
WILLOW			
Crown Gall	See BIRCH		
Leaf Blight or Scab	Prune and destroy diseased twigs and branches.		
Black Canker	Prune and destroy diseased twigs and branches.		

ORNAMENTAL SHRUBS, VINES, AND GROUND COVERS
DISEASE CONTROL MEASURES

GENERAL DISEASES

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
NEMATODES		DD or Telone Vapam, VPM, Mylone, methyl bromide, chloropicrin	(Pre-plant soil fumigants) Treat soil before planting. Do not use near living plants.
		Nemagon, Fumazone, VC-13	Use for established plants. Treat soil according to label recommendation.
POWDERY MILDEW	Spray with water from a garden hose	Wettable sulfur, benomyl Spreader-sticker	Spray at label recommendation when mildew appears. Use at manufacturer's recommendation.
SHOESTRING ROOT ROT or MUSHROOM ROOT ROT	Avoid injuries to roots and lower stems. Maintain vigor by fertilizing and watering. Remove and destroy affected shrubs, including roots; replace soil with uncontaminated soil. For new plantings remove all stumps and roots of dead oak and apple trees.		

-49-

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
AJUGA BUGLEWEED			
Crown Rot	Remove affected plants and the soil around their roots.		
ALDER			
Catkin Galls	Prune and destroy the diseased twig ends.		
Powdery Mildew	See GENERAL DISEASES		
ALMOND FLOWERING			
Blossom and Twig Blight	Prune and destroy affected twigs and branches.	captan 50% WP, 2 pounds per 100 gallons	If disease has been a problem in previous years, spray just before blossoms open, and again 7 days later.
AZALEA			
Angular Leaf Spot	Destroy fallen leaves.	zineb 75% WP, 2 pounds per 100 gallons	Spray 2 or 3 times at 10-day intervals as new leaves expand. Repeat 3 times from mid-summer into late fall.
Bud and Twig Blight	Prune and burn affected branch tips.	Fixed copper containing 50% metallic copper, 4 pounds per 100 gallons	Prevent infection of new buds by spraying monthly.
Cutting Rot	Root cuttings in sterilized cutting media, and transplant rooted cuttings to sterilized soil.	benomyl 50% WP, at label recommendation	If disease appears, drench cuttings at 10- to 14-day intervals.
Damping-off	Plant seeds in sterilized propagating medium. Provide good air circulation around propagating beds.	benomyl 50% WP, 1 level tablespoon per gallon	Drench seed-bed flats at the rate of 1 pint per square foot of bed surface.

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Petal Blight		benomyl 50% WP, at label recommendation OR zineb 75% WP, at label recommendation	Mist-spray flowers just as blooms are opening. Spray twice a week through blooming period.
Powdery Mildew	See GENERAL DISEASES		
Rust	Avoid planting azaleas near hemlocks.		
BARBERRY			
Bacterial Leaf Spot		8-8-100 bordeaux	Spray 2 to 3 times at 10-day intervals, beginning when new leaves appear.
Rust	Remove and destroy affected plants. Do not replant the location with barberry unless a volume of soil 3 feet square by 1 foot deep is replaced by new soil.		
BAYBERRY			
Rust	Do not grow bayberry near southern white cedar.		
BITTERSWEET			
Powdery Mildew	See GENERAL DISEASES		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
BOXWOOD			
Decline, Dieback	Remove affected branches by cutting back several inches below cankers. On large branches, remove small cankers by cutting back to healthy wood on all sides. Shape wound to a point at either end. Paint wounds with shellac, let dry, and cover with tree paint. In spring, before growth starts, remove leaves and debris lodged in crotches.	liquid lime sulfur, 2 gallons per 100 gallons	Spray before growth starts, when new growth is about half completed, after spring growth is complete, and after fall growth is complete.
Leaf Spot	Remove and destroy dead leaves.		
Nematode Injury	See GENERAL DISEASES		
BUCKTHORN			
Rust	(Causes negligible damage to buckthorn, but spreads to oats, causing oat crown rust.) Do not grow buckthorn in oat-producing areas.		
BUTTONBUSH			
Leaf Spot			(Usually not damaging enough to warrant spraying).
Powdery Mildew	See GENERAL DISEASES		
CHERRY, HANSEN'S BUSH			
Brown Rot	Prune and destroy infected twigs and branches.	captan 50% WP, 2 pounds per 100 gallons	During wet spring and if disease has been a recurring problem, spray just before blossoms open, and again 10 days later.

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	Notes
CHOKEBERRY			
Rust	Avoid planting chokeberry near southern white cedar.		
Twig and Fruit Blight	Gather and destroy fallen fruit before blossoms open.		
CLEMATIS			
Stem Rot and Leaf Spot	Provide good air circulation around base of plants. Remove and burn diseased stems, cutting well below the diseased area. Grow seedlings in new or sterilized soil. Take cuttings from disease-free plants.		
Leaf Spot	Same as for stem rot and leaf spot.		
COTONEASTER			
Fire Blight	Destroy any nearby diseased or neglected pear, quince, and apple trees. Between November and March, cut off affected branches at least 3 inches below the end of the cankered bark. Before each cut, disinfect the pruning saw or shears with denatured alcohol.		
DAPHNE			
Nectria Canker	Cut off and destroy infected plants.		
Stem and Root Rot	Plant in well-drained soil. Destroy diseased plants, and do not replant daphne in the same area.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
DUTCHMAN'S PIPE			
Leaf Spots			(Usually not severe enough to warrent spraying).
EUONYMOUS			
Crown Gall	Do not plant euonymous with galls on roots or stems. Avoid wounding stems or roots in cultivating. If disease appears, prune and destroy affected parts. Badly affected plants should be removed and destroyed.		
Powdery Mildew	See GENERAL DISEASES	benomyl 50% WP, at manufacturer's recommendation	
FIRETHORN			
Fire Blight	See COTONEASTER	streptomycin compound, 100 parts per million	Spray as the first blossoms open, and again 7 days later.
Scab		benomyl 50% WP, 1 pound per 100 gallons	Spray just before blossom time; repeat 3 to 5 times at 2-week intervals.
FORSYTHIA, GOLDEN BELL			
Stem Gall	Prune and destroy affected parts.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
HOLLY			
Leaf Rot or Leaf Drop	Set cuttings in clean, fresh sand or in sterilized sand. Avoid taking cuttings from holly branches that touch the ground.	37% formaldehyde solution, 1 pint per 6 gallons	If disease has been present, wash bench before filling it with fresh sand.
		benomyl 50% WP, 1 tablespoon per gallon	If disease appears, drench affected area once. Use one pint per square foot of bed.
Leaf Scorch	Pick off affected leaves.		
Spine Spot	Plant trees in sheltered areas, or erect wind barriers to prevent wind-whipping of the leaves.		
Tar Spot	Pick off and burn affected leaves.		
HONEYSUCKLE			
Powdery Mildew	See GENERAL DISEASES		
HYDRANGEA			
Bacterial Wilt	Remove infected leaves and flowers or discard infected plants.		
Gray Mold Blight	Cut off and burn infected flower clusters.	benomyl 50% WP, 1 pound per 100 gallons	If buds have been injured by late frost or if weather during bloom is wet, spray buds and flowers at 10-day intervals.
Leaf Spot	Cut off and burn severely affected leaves and flowers.	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray at 2-week intervals, starting when new leaves unfold.

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Powdery Mildew	See GENERAL DISEASES	benomyl 50% WP, at manufacturer's recommendation	
Rust	Water carefully because rust spores are spread by splashing water.	zineb 75% WP, 1 1/2 pounds per 100 gallons	Spray at 2-week intervals, starting when leaves are half grown.
IVY, BOSTON AND VIRGINIA CREEPER			
Leaf Spot	Where ivy on buildings is only lightly affected, pick and destroy spotted leaves.	ferbam 76% WP, 2 pounds per 100 gallons	Spray just before bloom, just after bloom, and again 7 to 10 later. Additional sprays may be necessary if leaf spotting appears later during wet weather. (Ferbam residue will discolor painted surfaces.)
Powdery Mildew	See GENERAL DISEASES		
IVY, ENGLISH			
Bacterial Leaf Spot	Avoid planting on sites where high temperatures and moist conditions occur. Avoid overhead sprinkling.		
Leaf Spot and Twig Blight	Remove and burn infected leaves.	zineb 75% WP, 1 1/2 pounds per 100 gallons	If disease has been severe, spray when new leaf growth starts, and again 10 days later.
Leaf Spot and Stem Blight	Same as for leaf spot and twig blight.		
KERRIA			
Leaf and Twig Blight	Cut out diseased twigs, and rake and burn dead leaves.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Twig Blight	Cut out and burn infected stems and twigs.		
LAUREL, MOUNTAIN			
Leaf Spot	Gather and burn fallen leaves and heavily spotted leaves that cling to the shrub.	benomyl 50% WP, 1/2 pound per 100 gallons; spreader-sticker, at manufacturer's recommendation	If disease was serious in preceding year, spray when new growth starts, and repeat at 10-day intervals until leaves reach mature size. If exceptionally wet weather occurs in September or October, repeat spray application.
Leaf Blight	Gather and burn infected leaves.	Same as for leaf spot	
LEUCOTHOE			
Leaf Spots	Pick off and burn infected leaves.		
LILAC			
Bacterial Blight	Prune to prevent dense growth. Cut out and destroy affected shoots as soon as they are noticed. Disinfect pruning shears with denatured alcohol.	8-8-100 bordeaux	Spray in spring as soon as leaves start to unfold. Repeat one or two times at 10-day intervals.
Leaf Blight		8-8-100 bordeaux	Spray in mid-June, and one or two times at 10-day intervals.
Powdery Mildew	See GENERAL DISEASES		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
Shoot blight	Same as for bacterial blight. Do not plant lilacs and rhododendrons close together because the same fungus attacks both shrubs.		
MAHONIA, OREGON GRAPE			
Leaf Spot	Pick off and destroy spotted leaves before new growth appears in the spring.		
MATRIMONY VINE			
Powdery Mildew	See GENERAL DISEASES		
MOCK ORANGE			
Leaf Spot		benomyl 50% WP, 1/2 pound per 100 gallons	Spray first when leaves are 1/4 inch long, and two more times at 10-day intervals.
NEW JERSEY TEA			
Powdery Mildew	See GENERAL DISEASES		
PACHYSANDRA			
Leaf and Stem Blight	Thin plants periodically to avoid dense growth. Remove severely diseased plants.	mancozeb 80% WP, 1/2 pound per 100 gallons	When new growth starts in spring, spray two or three times at weekly intervals.

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
PERIWINKLE, GROUND MYRTLE			
Blight	Thin planting to allow better ventilation.		
Canker and Dieback	Prune and destroy affected stems	benomyl 50% WP, 1 pound per 100 gallons	In March, drench the plants twice at weekly intervals.
PRIVET			
Anthracnose, Canker, or Twig Blight	Plant resistant varieties. When the disease is found, prune and burn all diseased branches.	ferbam 76% WP, 2 pounds per 100 gallons	Spray at weekly intervals until no new infections are seen. (Ferbam residue will discolor painted surfaces.)
Galls	Prune and burn affected stems.		
Powdery Mildew	See GENERAL DISEASES		
QUINCE, JAPANESE FLOWERING			
Fire Blight	Destroy any nearby diseased and neglected pear, quince, or apple trees.	2-6-100 bordeaux	Apply at mid-bloom. DO NOT use streptomycin sprays.
RED-OSIER DOGWOOD			
Botryosphaeria Canker	Prune and burn severely affected branches. Cut several inches below the cankered areas.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
RHODODENDRON			
Damping-off	Plant seeds in a sterilized propagating medium. Provide for good air circulation around propagating bed.	benomyl 50% WP, 1 tablespoon per gallon	Drench flats at rate of 1 pint per square foot of bed surface.
Leaf and Flower Galls	Pick and destroy galls as they appear.	zineb 75% WP, 2 pounds per 100 gallons; Spreader-sticker, at manufacturer's recommendation	Spray once before leaves unfold.
Leaf Spots (non-parasitic)	Use mulch and windbreaks.		
Leaf Spots (from fungus)		zineb 75% WP, 1 1/2 pounds per 100 gallons or ferbam 76% WP, 2 pounds per 100 gallons	As soon as new leaves appear, spray 2 or 3 times at 10-day intervals. (Ferbam residue will discolor painted surfaces.)
Powdery Mildew	See GENERAL DISEASES		
Twig Canker and Dieback	Lessen the shade, if possible. Prune all diseased branches well below affected area, and burn them.		
Wilt	Practice a rotation of frames in which stock is grown. Adjust soil acidity in seedling beds to pH 4 or 4.5. Use light soils with good drainage. Avoid overwatering. Do not plant rhododendrons in soil where previous plantings have been killed by wilt.		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	Notes
SERVICE-BERRY, SHADBUSH			
Rust	Do not plant service-berry near junipers.		
Witches' Broom, Black Mildew	Cut off and burn the affected leaves and twigs.		
SNOWBERRY			
Spot anthracnose	Prune the diseased stems to the ground.		
Anthracnose	Same as for spot anthracnose		
Berry Rot	Same as for spot anthracnose		
STAGHORN SUMAC			
Fusarium wilt	Remove and burn affected plants. Do not replant the location with staghorn sumac.		
Powdery Mildew	See GENERAL DISEASES		
SWEET FERN			
Rust	Do not grow sweet fern near pine nurseries.		
TRUMPET VINE			
Powdery Mildew	See GENERAL DISEASES		

DISEASE	CULTURAL RECOMMENDATION	CHEMICAL RECOMMENDATION	NOTES
VIBURNUM			
Bacterial Leaf Spot	Remove and burn all infected leaves.		
Powdery Mildew	See GENERAL DISEASES	benomyl 50% WP, at manufacturer's recommendation	Do not use sulphur.
WITCH HAZEL			
Leaf Spot		zineb 75% WP, 1 1/2 pounds per 100 gallons	(Spraying is not usually necessary.) If disease is severe, spray 3 times at 14-day intervals, beginning when leaves are 1/4 inch long.

SUGGESTED CONTROL FOR DUTCH ELM DISEASE

Cut and peel all trees infected with Dutch elm disease as soon as possible. Peel all stumps to below ground level. Any unpeeled branches larger than 1/2-inch in diameter may harbor beetles. Peel limbs or trunks saved for firewood. Chip or bury all remaining branches under at least 2 feet of soil. The beetle population and the threat of spread may be reduced by pruning all dead or weakened branches on non-diseased trees. This sanitation program is especially helpful in areas where the Dutch elm disease is just beginning to be a problem.

Where elms are closely planted (50 feet or less between trees) the fungus may spread through root grafts between trees. To prevent such spread, as soon as possible after the disease appears, dig a narrow trench or pass a root-cutting blade through the soil at the midpoint between the trees. A trench or cut 2 feet deep and extending beyond the spread of the branches will sever most tree-to-tree connections.

Another means of preventing spread of the disease by root graft is to treat the soil half-way between the diseased and healthy trees with Vapam, a liquid soil fumigant. This will result in a section of dead roots through which the Dutch elm disease fungus will not pass. Make a line of holes 6 to 8 inches apart and from 15 to 24 inches deep with an electric drill and 2-inch auger. The lines of holes should pass halfway between the trees and extend beyond the spread of the branches. Dilute Vapam 1 part to 4 parts water, and pour 1 cup of the mixture into each hole. As soon as each hole is filled, seal the top of the hole with a sod plug or by tamping it closed with the heel. For best results, the soil temperature should be at least 50° F. The grass may be killed for a short distance around each hole; this area may be reseeded about one month after treatment.

Beetle Control by Spraying -- Under most circumstances, it is impractical and uneconomical to try to prevent Dutch elm disease by spraying the trees to kill elm bark beetles. The difficulty of obtaining complete spray coverage in the tops of tall trees renders the spray programs only partially effective. The amount of protection provided by such a program is not sufficient to compensate for the cost.

Spraying elm trees for bark beetle control to protect against Dutch elm disease can be justified only for a few very high-valued trees. No spray program should be undertaken unless sanitation and removal of beetle breeding sites also are being done. To date, systemic insecticides have not satisfactorily protected trees from the disease.

SUGGESTED CONTROL FOR OAK WILT

Cut all trees infected with oak wilt and either peel or saw into lumber as soon as possible. Peel all stumps to below ground level. Limbs and trunks saved for firewood should be either split or completely peeled.

Where oaks are closely planted (50 feet or less between trees), the fungus may spread through root grafts between trees. To prevent such spread, as soon as possible after the disease appears, dig a narrow trench or pass a root cutting blade through the soil at the midpoint between trees. A trench or cut 2 feet deep and extending beyond the spread of the branches will sever most root connections.

Another way to prevent spread of the disease by root grafts is to place Vapam, a liquid soil fumigant, in a line of holes drilled 6 to 8 inches apart and from 15 to 24 inches deep. Use an electric drill and 2-inch auger. The line of holes should pass mid-way between the trees and should extend beyond the spread of the branches. For best results, the soil temperature should be at least 50° F. Dilute the Vapam 1 part to 4 parts water, and pour 1 cup of the mixture into each hole. As soon as each hole is filled, seal the top of the hole with a sod plug or tamp it closed with your shoe heel. This will cause a section of dead roots through which the oak wilt disease fungus will not pass. The grass may be killed for a short distance around each hole, but the area may be reseeded about one month after treatment.

In zones where oak wilt is a severe problem, pruning should be done only from November to mid-April.

In forested areas where the suggested controls are not feasible, the alternate control methods include felling all infected trees and all other oaks within a 50-foot radius of the infected tree. The stumps of all felled trees should be treated with an herbicide to prevent the stumps from sprouting. Personnel of the Bureau of Forestry, Forest Pest Management Section, Department of Environmental Resources, Harrisburg, will examine oaks suspected of having oak wilt and can give detailed advice.

DISEASE-RESISTANT TREES AND THOSE RELATIVELY FREE OF DISEASE

Some trees show resistance to some of the more serious tree diseases. Others react favorably to growing conditions found in Pennsylvania. Many of these latter trees are used only occasionally in shade and ornamental plantings, a fact that may account for the general absence of diseases. However, with the increased limitations on the use of effective fungicides for the control of tree diseases it would be advisable to check the lists below and select trees which may be substituted for trees which are undesirable because of their susceptibility to diseases.

DISEASE-RESISTANT TREES

Resistant to DUTCH ELM DISEASE:
Asiatic Elm
Ulmus parvifolia
U. pumila

Resistant to CHESTNUT BLIGHT, but susceptible to twig blight and canker:
Chinese and Japanese Chestnut
Castanea mollissima
C. japonica

Resistant to WITCHES' BROOM:
Chinese Hackberry
Celtis sinensis

Resistant to the *Diplocarpon* LEAF BLIGHT (serious on Paul's scarlet hawthorn):
Cockspur, Washington, and Toba Hawthorn
Crataegus crus-galli
C. phaenopyrum
C. mordenensis cv. Toba

Resistant to CEDAR APPLE RUST, FIRE BLIGHT, POWDERY MILDEW, and SCAB:
Flowering Crabapple
Malus cv. Adams
M. cv. Ames White
M. baccata var. *himalaica*
M. baccata cv. Jackii
M. cv. Beverly
M. cv. Burton
M. cv. David
M. cv. Gibbs' Golden Gage
M. cv. Gwendolyn
M. cv. Henry Kohankie
M. cv. Honeywood #14
M. cv. *kansuensis*
M. cv. Margaret
M. cv. Mount Arbor Special
M. cv. Ormiston Roy
M. cv. Pattie
M. cv. Professor Sprenger
M. cv. Robinson
M. cv. Trail

Resistant to LEAF BLOTCH caused by Guignardia aesculi:

Horse Chestnut

Aesculus arguta
A. glabra var. monticola
A. glabra var. sargentii
A. parviflora
A. parviflora var. serotina

Resistant to CRYPTODIAPORTHE CANKER:

Japan Poplar

Populus maximowiczii

Resistant to TWIG BLIGHT caused by Phomopsis juniperovora:

Juniper

Juniperus chinensis cv. Femina
J. chinensis cv. Iowa
J. chinensis cv. Keteleeri
J. chinensis cv. Pfitzeriana Aurea
J. chinensis var. Robusta
J. chinensis var. sargentii
J. chinensis cv. Shoosmith
J. communis cv. Ashfordii
J. communis cv. Aureo-spica
J. communis var. depressa
J. communis cv. Hulkjaerhus
J. communis Prostrata Aurea
J. communis cv. Repanda
J. communis var. saxatilia
J. communis cv. Suecica
J. horizontalis cv. Depressa
J. horizontalis cv. Depressa Aurea
J. horizontalis cv. Procumbens
J. sabina cv. Broadmoor
J. sabina cv. Knap Hill
J. sabina cv. Skandia
J. scopulorum cv. Silver King
J. squamata cv. Campbellii
J. squamata var. fargesii
J. squamata cv. Prostrata
J. squamata cv. Pumila
J. virginiana cv. Tripartita

White Cedar

Chamaecyparis pisifera cv. Filifera Aureovariegata
C. pisifera cv. Plumosa Aurea
C. pisifera cv. Plumosa argentea
C. pisifera cv. Plumosa lutescens
C. pisifera cv. Squarrosa Sulfurea

Resistant to LEAF BLIGHT AND BLACK CANKER caused by Pollacia saliciperda and Physalospora miyabeana:

Weeping and Bay-Leaved Willow

Salix babylonica
S. pentandra

TREES RELATIVELY FREE OF DISEASE

*Atlas Cedar Cedrus atlantica
Amur Cork-Tree Phellodendron amurense
Bald Cypress Taxodium distichum
Beech Fagus grandiflora and F. sylvatica
Cedar of Lebanon Cedrus libani
Cedrela Cedrela sinensis
*China-Fir Cunninghamia lanceolata
Cork-Tree Phellodendron sp.
*Dove-Tree Davidia involucrata
Eucommia Eucommia ulmoides
Franklinia Franklinia altamaha
Ginkgo Ginkgo biloba
*Glossy Privet Ligustrum lucidum
Golden Larch Pseudolarix amabilis
Honey-Locust Gleditsia triacanthos
Hop Hornbeam Ostrya virginiana
Hornbeam Carpinus caroliniana
Japanese Plum Yew Cephalotaxux drupacea
Japanese Rasin-Tree Hovenia dulcis
Japanese Torreya Torreya nucifera
Japanese Yew Taxus cuspidata
Kalopanax Kalopanix pictus
Katsura-Tree Cercidiphyllum japonicum
Kentucky Coffee-Tree Gymnocladus dioicus
Larch Larix decidua and L. eurolepis
Magnolia Magnolia sp.
Parrotia Parrotia persica
Pawpaw Asimina triloba
Persimmon Diospyros virginiana
*Phoenix or Chinese Parasol-Tree Firmiana simplex
Sassafrass Sassafrass albidum
Silverbell-Tree Halesia monticola
Snowbell, Styrax japonica, S. Obassia, and S. dayantha
Sorrel-Tree or Sour Wood Oxydendrum arboreum
Stewartia Stewartia pseudo-camellia and
Sweet Gum Liquidamber styraciflua
Tree-of-Heaven Ailanthus altissima
Tupelo Nyssa sylvatica
Turkish Hazelnut Corylus colurna
Umbrella-Pine Sciadopitys verticillata
Yellow-Wood Celastrus lutea
Yew Taxus sp.

*Hardy only as far north as southeastern Pennsylvania.

MIXING SMALL AMOUNTS OF WETTABLE POWDER FUNGICIDES

When using fungicides in the wettable-powder form, it is much more accurate to weigh the material than it is to measure it by volume. Wettable powders tend to settle in the container, and will fluff up when the container is moved. In either case, the amount of material in a measuring cup or spoon will vary, contributing to inaccuracy. Variations in the amount measured out for a 100-gallon batch may amount to as much as 5 ounces.

An accurate scale or balance should be part of the equipment of all commercial arborists, and all personnel doing the mixing should know how to use the equipment. Cleaning after each use is important; dirt on the scales leads to inaccurate weighing and can contribute to contamination.

Without a balance or scale, a volume measurement must be used. One level tablespoon of material in 1 gallon of water is roughly the same concentration as 1 pound of material in 100 gallons of liquid. This is of use only in very small quantities; commercial growers must weigh to achieve the accuracy necessary for effective control at minimum cost.

MIXING SMALL AMOUNTS OF LIQUID FUNGICIDES

Fungicide Recommended for 100 Gallons	Fungicide to Use in 1 Gallon
12 gallons	32 tablespoons or 1 pint
10 gallons	26 3/4 tablespoons or 4/5 pint
1 gallon	2 1/2 tablespoons
1 quart	5/8 tablespoon

EQUIVALENTS

Gallons	1						
Quarts	4	1					
Pints	8	2	1				
Cups	16	4	2	1			
Fluid Ounces	128	32	16	8	1		
Tablespoons			32	16	2	1	
Teaspoons				48	6	3	1
Milliliters				240	30	15	5

SAFETY PRECAUTIONS

Follow all precautions listed on the label. Store pesticides under lock away from food or feed, where there is no hazard to man or animals. Do not contaminate streams and ponds or otherwise endanger fish and wildlife. Protect your environment.

POISON CONTROL CENTERS

In case of suspected accidental poisoning, assistance is available from Poison Control centers, usually located in key hospitals. Your family physician and physicians at your local hospital will know how to obtain assistance from Poison Control centers.

PLANT DISEASE DIAGNOSTIC CLINIC

The Plant Disease Diagnostic Clinic, a free service of The Pennsylvania State University, tests diseased material, identifies the pathogen, and suggests remedies. Soils are analyzed for nematodes, their kinds and numbers are determined, and appropriate controls are recommended. Pennsylvania residents may obtain Plant Disease Clinic Kits at their county's Cooperative Extension office or from The Plant Disease Clinic, 218 Buckout Laboratory, University Park, Pennsylvania 16802.

Prepared by Lester P. Nichols, Professor, Plant Pathology Extension.

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8C1075 U. Ed. 6-328